SOIL CONSERVATION

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AN ICE STORM IN TEXAS

BY H. K. ROUSE [1]

DESTRUCTIVE ice and sleet storms in New England, in Pennsylvania, in Illinois, yes; but in the Panhandle country!

The ice storm of November 23 and 24, centering around Amarillo, demonstrated that "it can happen here"—in Texas. This was a storm that will take its place in song and story along with the blizzard of '88. Already tales of freakish happenings during the storm have taken on stature reminiscent of chuck wagon yarns. The 1,500 linemen rushed in from Houston, St. Louis, Denver, and a thousand miles around, performed feats worthy of a Paul Bunyan in restoring light, power, and communication.

Aside from heroic proportions, the bare facts of the storm are of absorbing interest. It was severe over an area roughly 100 miles square in the Panhandle of Texas, including the towns of Dumas, Channing, and Vega, in addition to the city of Amarillo with a population of 55,000. Less severely the storm extended as far as Tucumcari, N. Mex., and Dalhart, Tex. Notable features were the almost complete destruction by ice of all wire lines with resultant stoppage of light and power services, and disruption of all forms of wire communication; also, because of failure of power lines, water supplies were cut off or drastically limited. With telephone and fire-alarm lines down and water supplies extremely limited, it seems providential that no conflagration occurred. These conditions, beginning early in the morning of November 23, persisted until the afternoon of November 25.

At Vega, Tex., a county seat 35 miles west of Amarillo, the Soil Conservation Service conducts studies of precipitation and run-off on three watersheds. Recording instruments consist of seven recording rain gages, three water-stage recorders, and one hygrothermograph. All instruments functioned properly during the storm and excellent records were obtained. The following discussion is based on these records together with observations made by Harry Leonhardt, district conservationist of Oldham County wind erosion district, and Joe L. Harris, engineering aide, who services the instruments and collects the records from the run-off studies.

Prior to this storm there was a great deficiency of precipitation. The first 10 months of the year (1940) yielded only 8.20 inches, as compared with the normal for Vega, 18.20 inches. This shows a deficiency of 55 percent. The four preceding months—July, August, September, and October—had yielded but 2.78 inches of precipitation, a deficiency for this period of 72 percent, as compared with the normal 9.97 inches. The ground had become so dry and hard that many farmers were unable to plant winter wheat.

During November there was no precipitation until Tuesday, November 19. Rain, changing to snow, began that morning and continued intermittently for 24 hours with an average yield of 0.74 inch on the three watersheds. This precipitation soaked into the ground immediately, the snow melting almost as rapidly as it fell.

The storm of Saturday, November 23, began at 2 o'clock in the morning and continued, except for short intervals, until 11:45 Sunday night, a total of 46 hours. The total rainfall on the three watersheds averaged 3.5 inches, the catch of the several gages ranging from 3.21 to 3.74 inches. In character, the rain was gentle with small drops. The maximum intensity of rainfall

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was 0.35 inch per hour, and the maximum fall in any one hour was 0.23 inch, between midnight and 1 a. m. on November 24.

During the period of the storm the air temperature remained at 31° F., not varying more than 1° up or down, from 8 p. m. on Friday, November 22, until 2 p. m., Monday, November 25, when a rise in temperature began. This constant temperature was accompanied by almost complete cessation of air movement.

The combination of factors—the slow, cold rain, prechilled surfaces, a uniform subfreezing temperature and absence of wind—produced coatings of ice wherever the rain touched. Beautiful formations transformed weed patches into fairy gardens; slender wires grew to ropes as large as a man's arm; prosaic barbed-wire fences sagged to become festoons of crystal. Beauty soon was joined by destruction. Within 4 hours after the beginning of the rain, the high line serving Vega from the central station in Amarillo went out, leaving the town without light or power and with an almost empty water-supply tank. During the day the telegraph and telephone lines failed, and the town was without communication.

As the storm continued and the weight of the ice increased, wire lines continued to fail until, within the town, it was difficult to find two adjacent spans of wire still up. The not too recently built high-tension electric line suffered most severely. In many places 8 to 10 or more poles in succession were broken off; where poles stood, cross arms snapped. In a 10-mile stretch not over a dozen poles remained undamaged. The least severely damaged line was a telephone and telegraph transcontinental trunk line paralleling U. S. Highway No. 66 from Amarillo through Vega to Albuquerque, N. Mex. The local telephone lines and the railroad telegraph lines, which were less substantial, suffered so severely that they had to be rebuilt.

Normally the Texas Panhandle is a treeless plain; getting shade trees established is difficult, and once established they require careful maintenance. In the past 30 years, however, civic and individual effort had succeeded in establishing many beautiful trees along streets and surrounding homes. During the storm the ice formation on trees was beautiful, but soon the picture became tragic as the weight of the ice broke branch after branch. Practically every tree of any size suffered severe damage so that ruthless pruning or complete removal was necessary. The pruned trees present a pitiful sight; only the main trunk and 8 or 10 mutilated branches remain of what very recently was a spreading shade tree.

Fences, too, were severely damaged. Much wire will have to be restretched and many fences rebuilt. Livestock suffered some discomfort during the storm. All forage was completely covered with ice, and local stockmen were compelled to provide supplementary feed. Though the weather was hard on stock, no appreciable loss was experienced since the temperature did not drop below 30° F. and forage became available again on the fourth day.

All recording instruments functioned well and complete legible records were obtained.

This storm's characteristics were decidedly not of run-off producing quality. The intensity of rainfall was low, the ground was not frozen and was very dry following 4 months of drought. Where vegetation was plentiful canopy interception was great, holding back probably ⅓ to ½ of the total precipitation for from 12 to 36 hours after rainfall ceased. The records of the three watersheds are given in the following:

Watershed W–I (Bower), consisting of 130 acres, is divided into approximately equal areas of cultivated land and pasture. The cultivated land includes slopes of from ½ to 1 percent and had been planted to winter wheat. The pasture land has fair to good cover and an average slope of 2½ percent. The total run-off from this watershed amounted to only 0.002 inch; this means that practically all of the rainfall (3.45 inches) went into the soil. The peak rate of run-off was only 0.6 cubic foot per second.

Watershed W–II (Landergin) consists of 96 acres of range land with good vegetative cover and an average slope of 1½ percent. No run-off occurred on this watershed. All of the 3.21 inches of rain was retained.

Watershed W–III (Landergin) consists of 21 acres of rough, broken range land having a stony soil, sparse vegetative cover, and steep slopes averaging 10 and 30 percent. The slightly heavier precipitation (3.74 inches) produced much higher run-off from this watershed, but even here the total run-off amounted to only 0.5 inch (13.3 percent of the rainfall) and the peak rate of run-off was only 1.17 cubic feet per second.

The small percentage of run-off and consequent retention of most of the moisture in the soil has resulted in excellent soil-moisture conditions. Test holes dug 10 days after the storm showed good moisture to depths varying from 19 to 30 inches.

While the publicity given this storm generally classed it as a disaster, this was principally because 100,000 people in an area as large as the State of New Jersey were suddenly cut off from regular communication with the rest of the world. Property damage undoubtedly was heavy. The population suffered some

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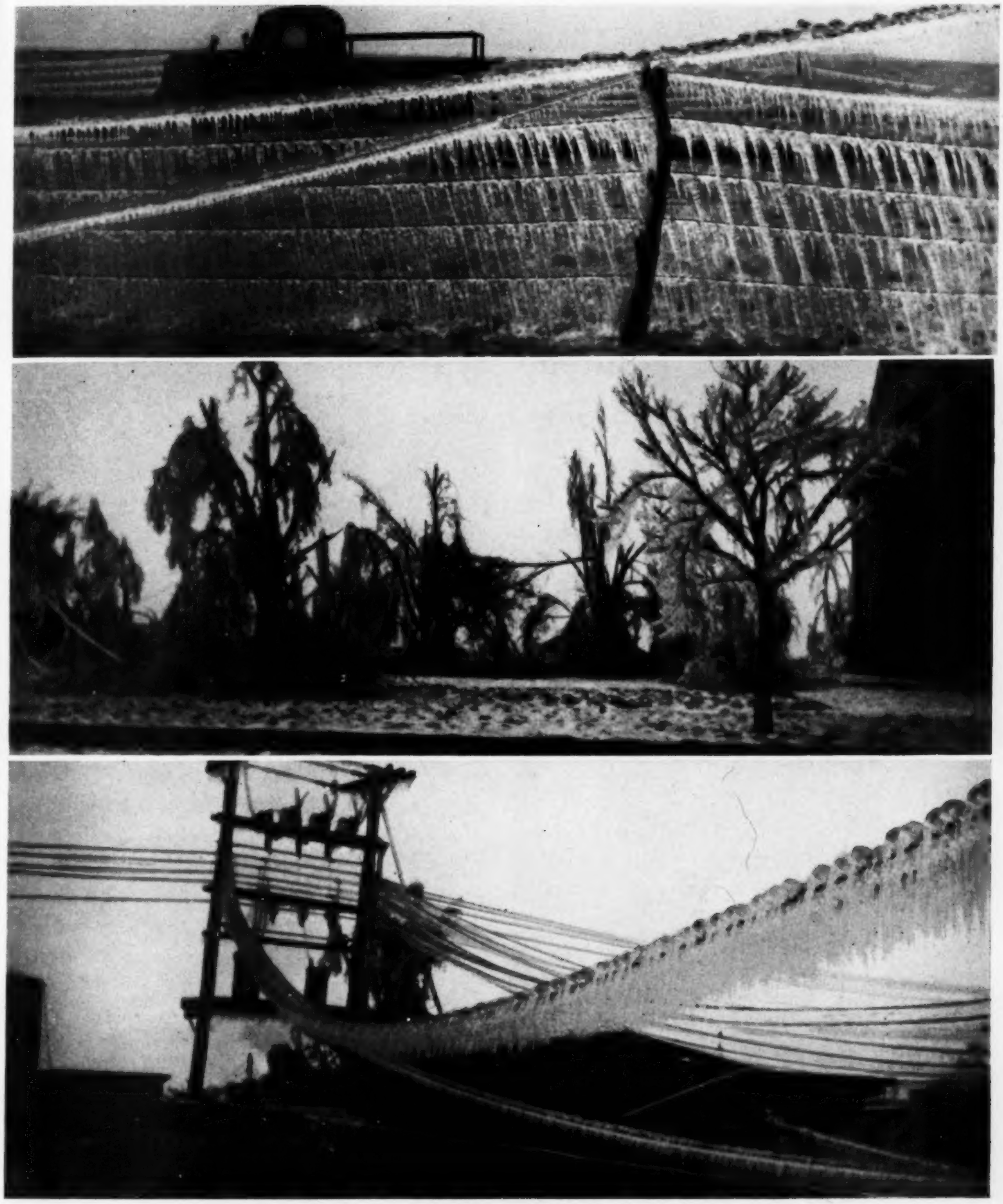

Top.—Typical ice-loaded fence and rural telephone line, Vega, Tex.
Center.—Ice-damaged trees in the Oldham County court-house park.
Bottom.—Local distribution lines of the electric-power company.

HARD WORK, BUT NO HARD TIMES

BY BARRINGTON KING

MACK GOWDER went about the job of farming the hard way when he bought a farm of his own on the steep slopes of Hall County, Ga., 20 years ago. His neighbors told him that if he had accumulated enough money to buy some land he ought to go to South Georgia where a fellow could raise twice as much with half the work that it took in those steep North Georgia hills.

But Gowder had his own ideas about farming and he wanted to put them into practice on his own land in the same neighborhood where he had spent his boyhood days on his father's farm. He figured he could raise as much as he and his two boys could gather and besides, he told them, he was "foolish" about the good spring water of the North Georgia hill country and didn't have any desire to "drink out of frog ponds"—meaning the shallow wells of flat country.

During the 20 years since Gowder bought 100 acres of woodland, cleared the land for his fields, and built his home on the top of a hill above a flowing spring with the timber he cut from his woods, there has been plenty of hard work on the Gowder farm, but no hard times. Today the farm is on outstanding example of what a Southern Piedmont farmer can accomplish, not under the most favorable, but under the most difficult circumstances any farmer is likely to encounter.

If there is any secret to the system that has made the Gowder farm outstanding—in a section where the best soil from hundreds of other farms long ago was washed into the Chattahoochee River—it is that Gowder has made conservation not only a principle of farming but a habit of living as well. He has followed consistently a few simple farming practices that have kept the soil of his cropland, woodland, and pasture in its original healthy condition; it never has been necessary for him to mine a living from eroded soil.

Note—The author is Regional information specialist, Southeastern Region, Soil Conservation Service, Spartanburg, S. C.

1. Mack Gowder examining timber in his 75 acres of woodland. The excellent litter under foot is a result of protection from burning.

2. Terraces and trashy cultivation on a field in Gowder's farm in Hall County. Residue in abundance was left from the previous corn crop.

3. Otis Gowder breaks the land with a special type of bull-tongue plow which loosens the soil to a considerable depth without turning it, mixing the plant residue with the top 2 or 3 inches of soil The mules are allowed to "just creep along" to prevent the strain of deep plowing.

4. Deep plowing is a key practice on the Gowder farm.

5. Mack Gowder examines a heavy mulch of cornstalks and weeds, with which he achieves protection for his land.

The practices that Gowder has been using are simple enough, but they are scientific in principle. His method of utilizing crop residues to protect soil from erosion is, in fact, a farm practice that stands far out toward the front in conservation farming. In other words, *he is now using on his Georgia hill farm a soil-protective system of farming that most of the Nation must come to, in one form or another, if we are to have complete conservation, and a permanent agriculture, in the United States.*

It is generally conceded that holding the soil and growing row crops on slopes of 15 to 25 percent, as Gowder has done, is an extremely difficult undertaking. A lot of farmers have tried it, usually with disastrous results; Gowder not only has made a good living from the land on his farm but he can say, and does, that the soil of his fields is better today than when the land was first cleared. When a Southern Piedmont farmer can say that, he can command attention wherever the subject of agriculture is discussed.

Mack Gowder doesn't carry out on his farm a definite conservation plan in the generally accepted sense of the term. The sequence of crops in his rotations is determined to a large extent by seasonal conditions, rather than by long-time planning, and he has followed with dogged Irish determination a few general principles that he knows to be sound. He had seen the soil wash away from local farms where he had worked and had refused to accept such loss as a natural result of making a living from the land. He resolved that if ever he had a farm of his own, he would maintain the land in its original fertile condition. Now he sees nothing very unusual about what he has accomplished; it is merely what he had set out to do 20 years ago.

"You've got to feed the land just like you feed a mule," Gowder says, and he has found that the best way to feed the land—or the mule—is to grow the feed. Stated briefly, his farming program includes (1) utilizing all crop residue on the land; (2) deep plowing with a sharp-pointed, modified bull-tongue plow that breaks the subsoil without turning the land, mixes part of the crop residue with 2 or 3 inches of the topsoil and leaves most of the crop residue on the surface; (3) contour tillage; and (4) simple rotations that include a large proportion of small grains, cowpeas, and O-too-tan beans, and a small proportion of cotton and corn.

Probably the most effective soil protection on the

Gowder farm is that provided by the heavy mulch of crop residue which can be seen on the land at any season of the year. In the fall, much of the land is planted to oats and wheat to provide some additional protection for the land and contribute feed for the livestock, wheat for the family flour bin, and a surplus for sale. Cowpeas, harvested throughout the fall whenever members of the family can spare the time to pick them, is another field crop which furnishes food, feed, and a supplemental source of cash income.

Gowder's idea of the importance of proper plowing gives an insight into the thoroughness with which he goes about the business of farming. He lets his mules "just creep along" when he is plowing his land, because deep plowing is hard on workstock even in the mellow soil of the Gowder farm; and besides, "a fellow can do better plowing when his mules don't go too fast." Most of the plowing is done in the fall when there is no rush about getting crops planted and when the ground, even if it is a little wet, has all the winter months to weather—"condition"—beneath the protective mulch of crop residue.

The only thing Gowder ever burned on his farm was the brush that was left when he cleared the land and used the timber to build his home 20 years ago. Since that time not a leaf, not a stalk, not a weed has been burned. All crop residue—cottonstalks, cornstalks, pea vines, bean stubble—is left on the land, the only exception being residue of O-too-tan beans that are cut for hay. When bean hay is harvested, small grain is planted to protect the land as soon as the hay is raked.

The only time he ever uses a turning plow is for plowing out the channels of his terraces. For all other plowing he uses a special type of bull-tongue plow (a modified "Georgia scooter") with a sharp point which he forges himself. After cutting up the crop residue with a disk harrow, he breaks the ground with this special plow which, by *plowing through the stubble* rather than turning it under, serves the double purpose of subsoiling and land breaking and mixes part of the crop residue with the top few inches of soil.

A typical rotation on the Gowder farm consists of corn, with cowpeas sowed in the corn when the crop is laid by. After the peas are picked, the vines are left on the land to be disked and followed by oats in the fall. When the oats are harvested the following summer, the land is plowed, peas are sown, and the litter again is left on the ground after the peas are picked.

Another rotation consists of cotton followed on part of the land by oats and another part by wheat, after the stalks are cut and the ground is disked. Peas are sown the following summer after the grain is harvested. After the peas are gathered the land is broken, and the litter is left on the ground. In the spring the land is disked and planted to cotton or corn.

Terraces appear to have been an afterthought on the farm "to take care of floods," as Gowder expresses it, and were built 5 or 6 years after the land was cleared, when most of the stumps had been removed from the new ground. The terraces—of the channel type, with a steep drop on the lower side which is necessary because of the steepness of the land—are spaced much farther apart than is customary and in some instances have a vertical interval of as much as 16 feet.

Because of the highly absorptive condition of the soil as maintained by the abundance of crop residue and the deep plowing, there is no appreciable run-off at the terrace outlets, "except with a rain of 4 to 6 inches in a night," Gowder told us. In spite of the fact that he grows his row crops on slopes of 15 to 20 percent, no evidence of soil washing is found in the terrace intervals, terrace channels, or at the terrace ends where Gowder has constructed simple rock outlets for individual terraces which empty into woods or road ditches.

When Gowder undertook the terracing of his land he did so only after the same kind of thorough study that he gives every farming operation. He ran the lines with a 12-foot triangle and a carpenter's level and limited the grade to a fall of 2 to 4 inches in 100 feet. To keep from removing too much topsoil from any part of the field, he explains, he used a drag pan for the construction job, starting well above the terrace line to get the soil for the ridge. Much this same method of terrace construction has been developed by the Soil Conservation Service and is now being used successfully in soil conservation districts in many parts of the Southeast and neighboring States.

Keeping his rows level to prevent the land from washing away was one of Gowder's first conservation practices. He has practiced contour tillage ever since he plowed the first furrow, long before his terraces were built. He says he has found that he can produce from one-fourth to one-third larger yields by spacing his rows far apart and planting his crops thick in the drill. He plants his grain in 18-inch rows and his cotton and corn in rows 4 to 5 feet apart.

With an allotment of 9 acres, he planted only 4 acres to cotton in 1940 and produced 4 good bales. Depending on conditions, he makes from 1 to 2 bales of cotton to the acre, 40 to 75 bushels of corn, 25 to 30

bushels of wheat, and 40 to 50 bushels of oats. Some idea of the effectiveness of his farming program can be gained from the fact that the average oat production for Hall County is 15 bushels per acre.

With respect to acre yields, Gowder's output is probably at least three times the average output of most similar farms in the locality. He is saving his soil and working a profit while doing so.

On a measured acre of land he has made 90 bushels of corn in a favorable season, and 5 years ago he sowed 5 bushels and 1 gallon of wheat on 6 acres and threshed 206 bushels of wheat. He uses 150 to 200 pounds of fertilizer per acre on most of his crops, as compared with 250 to 300 pounds used on the average farm in the section.

The cropland, however, has not been forced to carry the entire burden of providing the cash income for the farm. Of the 130 acres he now owns, Gowder keeps 75 acres of the steepest land in woods—woods that had been badly damaged by annual burning before he bought the farm. By protecting his woodland from fire and making improvement cuttings each year, he is developing an excellent stand of timber. He is harvesting a cord of wood per acre from the improvement cuttings, thus providing the largest cash return from any single crop on the farm.

By removing only the dead, diseased, misshapen, or stunted trees in his annual cuttings, he leaves the better timber to grow eventually into a crop of sawlogs. With the aid of a small motor-driven saw, he converts most of his cordwood into stovewood lengths which he delivers to regular customers in Gainesville and elsewhere for $6 a cord. The remainder, above his own fuel needs, he sells as cordwood in 4-foot lengths for $4 a cord. Gowder and his son Otis cut and haul most of the wood themselves.

An important factor in the successful operation of this farm—one not so apparent as is the mulch of crop residue that can be seen on the land—is Gowder's faculty for extending the principle of conservation far beyond its application to the soil. Even a casual observation will reveal that conservation has been carried into every phase of the operation of the farm as an economic unit.

The speedometer on a large 1936-model sedan under a shed back of the house registers only 2,600 miles, and except for the lines of the body it looks as if it might just have come off the assembly line. On the other hand, the truck that hauls products of the farm to market shows every indication of having made innumerable journeys over the 10-mile stretch of county roads to Gainesville and other nearby communities.

"Every time I take the car out of the shed it costs me money," Gowder explains with a twinkle of Irish humor in his eye, "but when I take the truck out I always bring back more than I had when I left."

When winter rains have turned the county roads into a sea of mud, the area between the house and barn is hard and dry; it is covered with a deep layer of gravel which Gowder hauled from an old abandoned railroad bed several miles away.

The devastating tornado that almost destroyed the town of Gainesville about 5 years ago missed the farm, but it ripped from buildings and scattered for miles across the countryside pieces of galvanized roofing which Gowder accepted in the literal sense as "windfalls." Most of the pieces were badly twisted by the fury of the storm, yet they serve very well as sides for various sheds and as covering for the stovewood that is always piled in the yard for future delivery to customers.

The bottoms of battered steel oil drums, salvaged in town, have been carefully cut off with a cold chisel to form heavy steel tubs about 14 inches deep to solve effectively and once for all the problem of indestructible hog troughs on the farm. The funnels Gowder uses for transferring gasoline from 50-gallon drums to his car and truck are made from large gourds merely by cutting the large part of the gourd in half and opening the end of the handle for a spout. Tin funnels could be bought at the 10-cent store for a dime, but Gowder grows his funnels along the fence for nothing.

Gowder always has something to sell and little to buy. Hickory, cut from his woodland, is shaped with a drawing knife into ax handles—he sells them for 25 cents each. Wheat straw for bedtick filling is sold to families in the neighborhood for 25 cents when they bring their ticks to the farm and fill them, and for 50 cents when he picks up the ticks in his truck and delivers them full of straw.

Gowder is "always experimenting on something." Over a period of 17 years, by careful selection he has developed his own variety of corn that produces ears of the desired size, shape, and number of rows with hard, flinty grains, and other characteristics. He sells 80 to 90 bushels of corn a year; about half of it is seed corn which brings $2 a bushel.

Oats are cut and fed unthreshed, and of the 75 to 150 bushels of wheat produced, about 30 bushels are used for flour and the remainder is sold. Approximately 75 bushels of peas are harvested each year, of which 40 to 50 bushels are sold.

Some vegetables are sold from the garden as well as a little surplus fruit from 20 apple trees, 20 peach

trees, 5 cherry trees, and scuppernong and grape vines, although all feed and food crops are considered first from the standpoint of home needs. Coffee, sugar, and salt are about the only staple items on the purchase list of the Gowder farm.

Livestock includes 2 mules, 4 cows, 1 boar, 2 sows and 8 pigs, and about 40 chickens. Some milk, butter, and poultry products are sold to a few regular customers on Gowder's trips to town, and the sale of pigs nets around $50 to $100 a year. Most of the livestock products, however, are consumed on the farm.

In addition to the 100 acres he bought 20 years ago, Gowder recently purchased an additional 30 acres. Most of it is being developed for pasture, but he expects it will be a long time before he gets it in the same condition as his "old" land. Some of the new land he has planted to kudzu, and he has also a small amount of *Lespedeza sericea* which he uses for hay, along with his O-too-tan beans. About 28 acres of his old land is in cultivation, with 2 acres in the house site and garden.

Often Gowder is urged to sell the timber on his 75 acres of woodland; and for some time a salesman has been after him about putting in a ram to pump water to the house. As to the timber, he knows that with the careful management he has given his woodland, the trees are just now reaching the stage where they are really making volume growth. He is still uncertain about the ram to pump the water to the house; maybe that mountain water might not taste as good as it does when he carries it in a bucket up the steep hill from the spring.

No electric line is available in the vicinity of the Gowder farm. The spring at the foot of the hill takes the place of an electric refrigerator. Meals prepared on a wood range with fuel produced on the farm somehow seem to be cooked to just the right degree without the aid of heat-control gadgets, and an open log fire that would be the envy of many a city housewife fills the house with warmth and cheer on chill winter evenings. There is a modern touch, however, to the kerosene lamps with Welsbach mantles that give an amazingly fine light and still retain the simple charm of the rooms.

Gowder's wife and seven children have helped keep the farm on a paying basis through fat years as well as lean. The farm has experienced 2 severe droughts during the past 20 years, but there has always been plenty of food on the table and a savings account in the bank. The two boys, Otis, 28, and Frederick, 23, were graduated from North Georgia Agricultural College at Dalonega. Otis and his wife live on adjoining land and help with the work on the farm, but Frederick decided he "didn't want to follow a hard tail (a mule) all his life" and moved away to town.

Two girls finished high school at Clermont and are now married and living on nearby farms. Three younger girls, ranging in ages from 17 to 9, are still on the farm and attend the consolidated school at Brookton.

Gowder himself attended a one-room school in his home community. He started to school at an early age. His mother died when he was a baby and there was no one at home to look after him but two sisters—when the youngest sister started to school he went with her. The one-room school at Dewberry community was heated with a fireplace and young Mack helped the other boys bring in wood for the fire. One lesson learned in these early school days has stuck with him ever since—always keep plenty of dry wood on hand against a rainy day.

All members of the family are musical, and singing is one of the chief diversions on the farm. Ever since the first two children were old enough to join in the harmonizing there has been a vocal quartette, and someone to play the piano accompaniment. Members of the family take part in "singing conventions" in the nearby counties as well as in their home community.

A visitor in the Gowder household may enjoy an unusual experience when in the evenings after the supper dishes have been cleared away the family gathers around the piano in the parlor to sing with mellow harmony some long-forgotten song. The uncertainty of events across the sea seems very far away, but the security that all the world is seeking is very near indeed.

In Chief Bennett's opinion, Mack Gowder has made a contribution of national importance to the science of soil conservation, particularly in his method of conserving crop stubbles and plowing deep without turning the soil.

AN ICE STORM IN TEXAS

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inconvenience, perhaps even a little hardship, but there was no real suffering. The farmer will be put to some extra work and expense in repairing fences and rural phone lines, but he suffered no loss of crop or livestock. The one great and irreparable loss is to the shade trees.

On the other side of the ledger, the moisture put into the ground is of incalculable value. It made it possible for many farmers to plant their principal crop, winter wheat, and the soil-moisture conditions resulting from the peculiar storm are the best in many years. The farmer is almost certain to harvest a good crop, even though the first half of 1941 may be deficient in rainfall.

FARMERS WORKING TOGETHER, TOMBIGBEE-WARRIOR DISTRICT

BY JOHN C. SLONE [1]

TO assume that sound farming can be achieved in a soil-conservation district without group action is somewhat visionary and at variance with the history of education. Group action as a means of promoting education of the masses is not a new technique. Some of the early records of teaching deal with groups. The early characters of the Bible were given instruction and teachings, then told to call their tribes together into groups and disseminate the information to them. The practice of instructing by groups has proved its value down through the ages and is now evident in our churches, schools, colleges, political rallies, and community meetings.

It has been said that the difference between presenting an idea convincingly to an audience of 1,000 persons and to an audience of one person is that the latter is more difficult than the former. An audience of 1,000 persons usually will listen to the speaker without interrupting him, but the one person audience is likely to interrupt over and over again. Unless the person trying to get a statement across to the audience of one is well prepared, he is likely to find himself confused.

Yet, a person may go before an audience of one person with but a vague idea, if any, of what he is going to say. He hopes to plunge in and get through somehow. No person with any consideration for his cause, his audience, and himself would go before a large audience without a carefully prepared talk, with his points arranged in logical sequence, his arguments carefully thought out, and the entire address well fixed in his mind. This applies equally to professional agricultural workers and is one of many sound reasons for giving consideration to group action in a district program.

Another reason for using the group-action method in a district program is the saving in time and money and the increased efficiency made possible by dealing with groups as compared with the individual-contact method.

The general belief among agriculturists is that one of the greatest handicaps to the establishment of an improved agriculture is the lack of interested, intelligent local leadership. It is necessary to develop the traits of leadership in several persons of each community so that a progressive program may be built up from discussions of these leaders, with the interest of the whole community in mind.

I believe that the progress that has been made in the program of the Tombigbee-Warrior Soil Conservation District in northwest Alabama can be attributed to the application of group action. I am not foolhardy enough to intimate that we know all the answers, or that we even know many of the answers; but, we have found that the leaders in the local communities are interested not only in their own soil-conservation problems but in those of their neighbors as well, and that they are willing to encourage concerted action in solving them.

Since the beginning of actual operations in the Tombigbee-Warrior Soil Conservation District in Alabama, which was about October 1939, the district has helped farmers within its boundaries to accomplish much soil-conservation work on their farms.

Six hundred and sixty-three farm-conservation plans, involving many more farm families and covering 86,176 acres, have been developed in the district. Establishment of many of the practices called for in these plans is going forward at a creditable rate. For instance, 2,700 acres of improved rotations and about 1,500 acres of perennial vegetation have been established on eroding lands, and meadow outlets have been prepared for several hundred acres in advance of terrace building—and terrace construction is above obligations in the agreements.

Most of this work is now being undertaken through the community group approach. This is evidenced by the fact that 38 community group meetings have been held and attended by 626 farmers; 236 other educational meetings have been held by the district, with the result that requests for group farm planning work have come in from many communities. Tours and demonstrations pertaining to soil-conservation work have been participated in by more than 1,100 farmers. Soil conservation, community by community, has become the theme among the farmers as well as the agencies assisting the district.

Let us take the New-Home Community of Marion County, a part of the Tombigbee-Warrior district, as

[1] District conservationist, Soil Conservation Service, Tombigbee-Warrior Soil Conservation District, Winfield, Ala. The article is adapted from an address delivered by Mr. Slone before the Association of Southern Agricultural Workers, Atlanta, Ga., February 6, 1941.

an example. This community is located 12 miles from Hamilton, the county seat, and 6 miles from a railroad and a paved highway. The soils are naturally poor, the farms small, hilly, and badly eroded as a result of producing row crops. The owners operate the farms with family labor in most instances and the income is low. About the only thing outstanding about the community is its leadership.

When the district began operation late in 1939 a general educational meeting was held in this section of the county, and J. G. Davis who attended the meeting made application to the supervisors for assistance in farm planning. When, early in 1940, Mr. Davis had not yet received assistance, he went to see County Agent E. G. Small. In the meantime, the district supervisors had decided to change their approach to farm planning from the individual-contact method to the group-action method. Mr. Small explained the change in procedure to Mr. Davis, and pointed out that the available technical personnel for farm planning was limited, that farmers' problems were similar, that problems of erosion did not begin or stop at property boundaries, and that any material or radical change in agriculture in his community must be sponsored by the farmers of the community. Mr. Davis agreed that the reasons were sound, but insisted that he needed assistance and was interested in considering the program in more detail. Mr. Small suggested that he discuss the new procedure of group action with his neighbors to determine whether there was sufficient interest to justify the organization of a group in his community for promoting soil-conservation work. He also assured him of assistance from the district supervisors should there be sufficient interest to justify action.

Mr. Davis returned to his community, discussed the new procedure with his neighbors and learned that they were willing to join in asking for assistance from the district in an organized approach to the solution of their problems. He called a meeting of all farmers in the community at the community center and invited the county agent, the district work-unit technician, the Farm Security Administration supervisor, and the vocational teacher to meet with them. Mr. Davis presided at the meeting and introduced all visitors to the group. He then outlined the reason for calling the meeting and gave a general statement of the need for assistance from the district. He asked County Agent Small to give a general discussion of the district conservation program as it affected his community. He then asked the work-unit technician who represented the district to give a detailed explanation of the district program. Visual aids were used in this discussion. The Farm Security Administration supervisor and the vocational teacher were requested to join in the discussion and they outlined the contributions which they could make to a community program.

When the discussions were ended Mr. Davis stated that he was willing to proceed with a complete conservation program on his farm in cooperation with the district, and he asked his neighbors to join him in a community-wide program. Fourteen of his neighbors made application to the district supervisors for assistance at this meeting. The farm of Mr. Davis was selected by the farmers to be used for field study in farm planning since it was centrally located and fairly representative of the group. A date for the field study was set and the meeting was adjourned.

The work-unit technician asked a soils technician to complete a conservation survey for the farm of Mr. Davis and, when this had been done, the remainder of the farms in the group were surveyed. He used this conservation survey and the land-use-capability map to assist Mr. Davis in preparing a complete conservation plan for his farm prior to the date set for the group field meeting. Conservation survey and land-use-capability maps were made for all farms in the group before the next meeting.

The fifteen farmers who made application for assistance met on the Davis farm at the agreed time and Mr. Davis led them over his farm, discussing the proposed changes and treatments. He was assisted in this by the work-unit technician. Questions were asked and explanations were made as the study progressed. An effort was made to get each farmer to visualize his individual farm as the various practices were discussed.

When the field study in farm planning was completed, each farmer was given a conservation-survey map and a land-use-capability map for his farm. The work-unit technician explained the symbols and how they should be used in farm planning. Each farmer was asked to take his maps home, go over his farm, and prepare a farm plan using the information gained at the meetings. The work-unit technician arranged to assist each farmer individually in completing his farm plan as rapidly as possible.

In no instance did the individual farmer make a complete farm plan as we think of the term; but in all cases the farmer associated the proper treatment with the problem and it was only necessary for the planning technician to make certain refinements, prepare the land-use map, assist in planning rotations, and prepare the agreement form. The usual long discussions as to

the proper treatments needed were eliminated as the farmer had incorporated into the farm plan such practices as he thought would help him with his problem. It became his farm program, prepared by him with the assistance of a technician in whom he had confidence—a program planned to fit his particular needs. Naturally, in these circumstances the farmer would feel proud of his accomplishment and would try to bring his program to a satisfactory completion.

After the farms were planned the next step was the establishment of practices, as without the conservation practices a conservation program does not exist. The farmers of this group have many practices in common, and because of this Mr. Davis invited a trained agriculturist to meet with his group to teach them how the practices should be established. The place of meeting was selected, the materials and equipment were procured, and the group assembled. Full reasons for doing the job were given by the agriculturist, the technique was demonstrated, and then the farmers were encouraged to try their hand at it. They learned the method by doing the job.

It did not make much difference whether the practice studied was terrace construction, terrace maintenance, kudzu planting, preparation of seedbeds, timber-stand improvement, or pasture development. The procedure for organizing the meetings was essentially the same. It was important, however, to stress the reasons for doing the job as demonstrated, and the necessity, in many cases, for doing it at a particular time or season. This was true not only for the purpose of establishing the practice properly but for the purpose of developing the traits of leadership.

It will be noted that the leader, Mr. Davis, had a prominent part in the whole procedure. I think that this is a point to be given emphasis, because capable and interested leadership is the keynote of success in group action.

Twenty-four community groups have been organized within the Tombigbee-Warrior Soil Conservation District, with approximately 275 district agreements for carrying out soil-conservation practices. Some of the groups have been much more effective than others, but all have shown advantages over the individual contact method.

I believe that it is very desirable to hold a field meeting between the farmers and the technicians if there is an established Soil Conservation Service project or a C. C. C.-camp area within reach. The group should be shown the established practices so that they will have a better understanding of what is proposed. No established project was available for this group, however, and the field meeting was omitted.

With the development of proper local leadership a far greater progress can be visualized than has yet been attained. Why cannot several individuals who have the ability of leadership become interested in a conservation program for their community, just as they are now interested in the school and church? It seems just as plausible that farm community leaders should remind their neighbors of the time to maintain terraces, mow pastures, plant winter legumes, plant grain crops, or fertilize pastures as to remind them that a "singing" will be held on Sunday afternoon at the community center. This form of leadership might have a more tangible effect on the social well-being of a community than would the same time spent in the more traditional forms of leadership.

It seems to me that the solution of group action by farmers hinges to a large extent around the ability of the professional agriculturist to gain the confidence of the farmers, direct them in an understanding and solution of the problems at hand and imbue them with a determination, desire, and eagerness actually to take the position of leaders. Many professional agriculturists do have the ability to gain the confidence of groups. Those who do not have it certainly could become more proficient by studying their subject matter and personal approach and becoming more enthusiastic about their cause. Very few can listen enthusiastically to a speaker who has but a sketchy knowledge of his subject and who lacks enthusiasm.

It seems essential that southern agriculture make drastic changes within a relatively short period to meet the conditions caused by national and international affairs. A well-organized community that is functioning as a group under local leadership, with the advice of qualified agriculturists, can make the needed changes much more efficiently than the same number of farmers each acting independently. On the other hand, it is undesirable for an agriculturist to assume that all farming practices in any community are wrong and to attempt to revolutionize a system within a year. A worth-while change in agriculture takes a longer time and can be carried out more satisfactorily when all parties are contributing to it. Farmers, by working as a group, can revolutionize their cropping system and farming program rather rapidly if they have interested local leadership with a vision that incorporates the whole community.

The teacher of vocational agriculture has an enviable position in the community. Usually he has become

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ELECTRIC POWER AIDS SOIL CONSERVATION

BY HARRY SLATTERY [1]

THE electric distribution lines spreading over rural America at an unprecedented rate provide new tools for the soil conservationist. He can use the availability of electricity to encourage diversification in one-crop areas. He can use it to bring about better pasture management. He can use it to foster improved irrigation pumping practices in the arid regions and to encourage supplemental irrigation, where desirable, in the humid regions.

Indirectly, rural electrification can assist the soil conservation program by providing power for local industries. Such industries can help to check human erosion in three tangible ways. They can make part-time farming practicable in many marginal areas where it is difficult, perhaps impossible, to earn a decent living by farming alone. They can provide jobs for farm boys and girls who cannot be absorbed on the farm. They can provide a home market for farm products that must be processed for ultimate sale to distant consumers. All this is apart from what electricity can do to make the farm and the rural community more attractive to the boys and girls who grow up there.

The foregoing statements are based, not on conjecture, but on experience gained during the past 6 years in widely differing communities in 45 States. The Rural Electrification Administration, now part of the United States Department of Agriculture, was set up on May 11, 1935. Since that time, the ratio of American farms having central station service has increased from just over 1 in 10 to nearly 3 in 10. In round numbers, the increase has been from 744,000 to 2,100,000. Roughly half of the newly electrified farms get current from R. E. A.-financed lines, most of which are operated by cooperatives and other nonprofit organizations, including a few public bodies. The rest are served by private utilities and by various public agencies that have not used R. E. A. financing.

Coincident with the increase in farms served during the past 5 years has come vast widening of service areas. This has been due chiefly to R. E. A. From the first, the agency has insisted that its borrowers adopt the principle of area coverage. Newly formed cooperatives plan their power systems in advance so as to reach as many farms as possible, instead of running a few lines along the main roads and leaving farmers in the thinner territory to fend for themselves. Through a combination of simplified construction and large-scale operation, R. E. A. brought down the cost of rural lines from the old range of between $1,200 and $2,000 to less than $1,000 a mile at the outset; today the average over-all cost of R. E. A.-financed lines is below $800 a mile.

Gordon Inskeep stirring liquid in a beaker on an electric hot plate, Soil Conservation Research Station, Coshocton, Ohio.

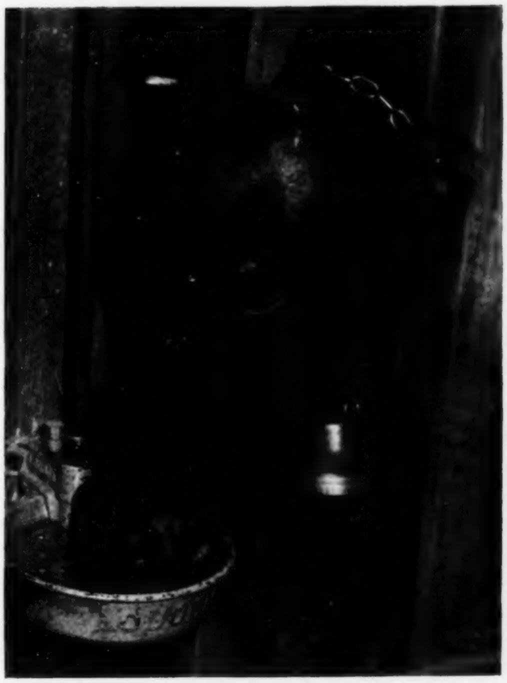
During R. E. A.'s first year, it financed a few lines. Before it could begin large-scale operations, it had to develop new techniques. It also had to foster a relatively new type of electric power organization, the farmers' cooperative. The private utilities, which many had expected would be large borrowers, if not the principal borrowers, have failed, with a few notable exceptions, to take advantage of the extremely favorable terms on which R. E. A. funds are offered.

Nonetheless, the utilities promptly began to increase

[1] Administrator, Rural Electrification Administration, Washington, D. C.

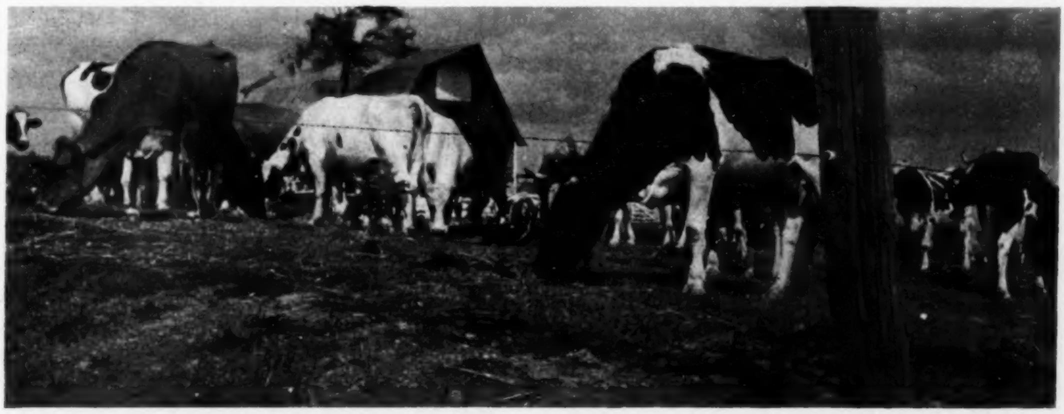
their rural mileage. Whereas rural electrification in 1934 was dead on its feet and utility spokesmen were explaining that electricity was going to farms as fast as was economically feasible and that it would be futile to speed it up, during the next 5 years they found rural service so far profitable that they increased the number of their farm customers by more than half a million. In many areas they have made their terms of service less onerous and have lowered their rates. Today the utilities have largely abandoned the practice of requiring a farmer wishing service first to advance all or a large part of the cost of the extension required to serve him.

Hand in hand with the widespread extension of electric service to rural areas has come an increasing emphasis upon productive use of electricity on the farm and in the farm home. The old notion that electricity is a luxury which the farmer cannot afford is giving place to realization that it is a necessity he cannot afford to do without. R. E. A., the research agencies of the Department of Agriculture, the Tennessee Valley Authority, the Extension Service, State agricultural colleges and experiment stations, and manufacturers of electrical supplies and of farm machinery have cooperated in developing new equipment adapted to farm needs and in finding new uses for existing equipment. In a recent magazine article, Harry T. Garver of the Bureau of Agricultural Chemistry and Engineering estimated that there are now more than 250 uses for electricity on the farm and in the farm home. A single agricultural college is conducting 200 separate experiments that involve the use of electricity in farm operations. The files of R. E. A. are full of reports that tell how farm people all over the country have used electricity to increase their income, either by saving money, or in many instances by actually making money. Meanwhile everyone interested in rural electrification concedes that only a beginning has been made in the profitable use of electricity in agriculture.



Stanchion cups furnish water for the cows.

Experience thus far indicates that a farmer accustomed to devoting all his energies to a single crop takes the first step toward diversification when he begins to produce part of his own food. He may start a flock of chickens. He may get a pig or a cow. He may plant a garden. Whatever he does, electricity



After one or two encounters with the electric fence, livestock soon learns to stay at home on the R. E. A. electrified farm near Herndon, Va. The electric fence, although effective, is harmless.

can help him. In the long run, it can help him directly by brooding his chicks economically and efficiently, by stimulating egg production during the winter months, by keeping his eggs and milk cool and fresh, by pumping water so that he can sprinkle his garden during dry spells. Before it can give such direct help, of course, the farmer must buy or build the necessary equipment.

Fortunately, the soil conservationist does not need to wait for the farmer to get electrical equipment, or even to begin taking service, before he can use a new rural electric power system as an opening wedge for diversification. The very fact that such a system has been organized and is about to be built gives him a chance to point out to prospective members the advantage of raising part of their own food or of developing supplemental sources of income.

Typical of what can be done during the early stages of a rural electric power system is the work of one Georgia county agent 2 or 3 years ago. His was a county in which cotton- and tobacco-growing were the major farm activities. He had been preaching diversification for years with little success. As soon as R. E. A. made an allotment to a newly organized cooperative in his county, he began calling on the members. He talked over with them the coming of electricity. In the course of the conversation, he invariably brought up the question of how to pay the electric bill.

The county agent would remark that it seemed hardly wise to take on a new expense without at the same time finding a new source of income or saving. Generally the farmer would agree and ask for suggestions. That request was what the county agent had been angling for. Having received it, he suggested some source of home-grown food—a flock of chickens, an extra pig or two, a cow, or a garden plot. These suggestions bore fruit to the common advantage of the farm families and their cooperative.

After the new lines are in service, conservationists and R. E. A. alike have a stake in productive use of electricity. Primarily, R. E. A.'s interest springs from the fact that generally the sole security of its loans is the electric power system of a cooperative, and the sole source of principal and interest payments is the revenue that the cooperative receives from the sale of electric energy. Inasmuch as the loan normally runs for a quarter of a century, R. E. A. has a direct interest in the permanency of the agriculture of regions where it has or is likely to have investments. Inasmuch as such regions are found in all but 3 of the 48 States, the interest of R. E. A. in a permanent and prosperous agriculture in all parts of the country is highly practical.

It is essential for the successful operation of a rural electric system that its members use electricity liberally. It is equally essential that they use it wisely, as otherwise many of them are likely to find that liberal use is a luxury they can ill afford.

Fortunately many of the more than 250 known uses of electricity on the farm and in the farm home are productive. Fortunately, too, those that are most likely to benefit the single-crop farmer require little initial investment. For instance, poultry-house lighting, which increases egg production during the months of short daylight and high prices, requires only a single bulb for every 100 hens. Any farmer handy with tools can build an efficient electric chick brooder at small expense; he can obtain plans at his R. E. A.-system office. The farmer producing eggs or dairy products on a small scale can keep them fresh between deliveries, thus often receiving a better price, by storing them in his domestic refrigerator.

In a great many instances, savings effected through the use of electricity are substantial. Dairymen are finding electrical milk cooling to be not only more efficient than ice cooling but also less expensive. This is as true in northern regions, where natural ice can be cut from lakes and ponds and stored on the farm, as it is in the South and far West, where the farmer without artificial refrigeration must buy manufactured ice. Similarly, farmers who keep careful records have established the fact that electrical chick brooders are less expensive to operate than coal- or oil-burning brooders, as well as being safer and in other respects more satisfactory. Similar savings can be effected, in many cases, by the use of small electrically operated feed grinders; since such grinders can easily be set up for automatic or semiautomatic operation, the saving includes time, operating expense, and original investment. These examples of savings through the application of electrical energy to farm operations are only suggestive.

While the primary purpose of the R. E. A. program is to take central-station service to farms hitherto without it, R. E. A. systems also serve a wide variety of nonfarm consumers—churches, schools, country stores, filling stations, and various local industrial plants, as well as rural village homes. In many areas small plants powered by R. E. A. systems are providing part- or full-time employment to members of farm families. In addition, many of these plants process local raw materials, thus affording a market to farmers

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FIELD UNIT PLANNING

BY HARRY H. GARDNER[1]

FIELD unit planning has developed out of several years of experience in soil-conservation work In the early days Service technicians did all the farm planning, using various soil conservation practices in the effort to determine the best methods of conserving soil and moisture and to reduce erosion. Farmers knew little about the work and were willing to have the planning done for them.

With the advent of soil-conservation districts, farmers started to work out their own conservation problems with perhaps some assistance from Service technicians. This involves change in planning procedure: Farm plans must be simple, and the farmers must help develop them; crop rotations must really rotate, and the farmers themselves must be able to make necessary changes in the rotation without affecting the size or shape of strips or fields. Experience has shown that a farmer will follow a plan which he understands, one that is workable and flexible enough to stand changes in the farm enterprise or economic conditions.

These four distinct steps should be followed in field unit planning: (1) Delineating various land uses—the separation of cropland, permanent hay land, pasture land, woodland; (2) dividing the cropland into practical field units easily accessible for farm operations and for grazing; (3) developing a suitable crop rotation; and (4) planning the necessary supporting conservation practices.

The plans for three farms are presented here to explain the field unit method of planning. Figure 1 is a map of a 240-acre farm as it was operated by the farmer. The high percentage of clean-tilled crops should be noted, and also the arrangement of fields without regard to topography. Only the more nearly level land was used for cropping, while the rough land was fenced out for pasture. The farmer, to a certain extent, had learned something of proper land use by experience; but he had not learned how to maintain cropland in continuous cultivation withcut excessive soil losses.

Figure 2 shows a map of the farm with all four steps in field unit planning completed, i. e., areas have been delineated according to land use, the cropland has been divided into five field units, the rotation has been developed, and the supporting conservation practices

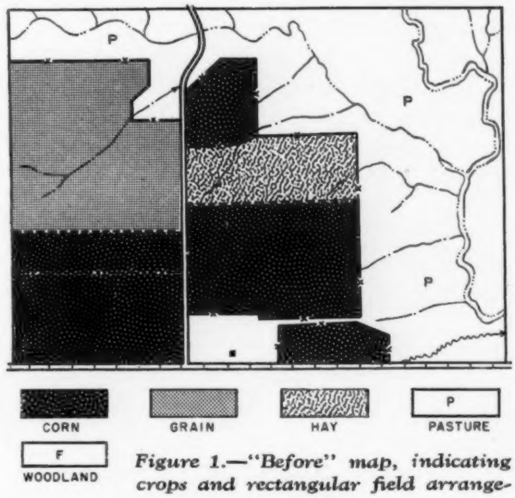

Figure 1.—"Before" map, indicating crops and rectangular field arrangement.

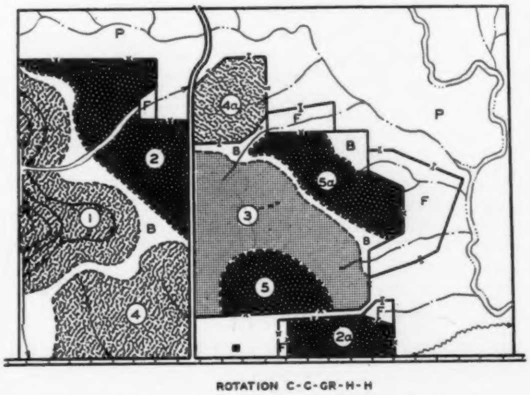

Figure 2.—Map of same farm, showing the four essential steps in field unit planning: (a) proper land use delineated; (b) cropland divided into five units; (c) rotation of C-C-Gr-H-H planned; (d) supporting conservation practices established, terraces and contour buffer strips (B).

have been established. In order to maintain proper balance of crop acreage it was necessary to lay out some of the units in two fields. For example, fields 2 and 2a are worked as a unit, likewise 4 and 4a, and 5 and 5a. The rotation of corn-corn-grain-hay-hay is common rotation that has been recommended for this area for a long time, but the arrangement of this rotation in the five units to be farmed on the contour is an adaptation to conserve the soil resources of the farm. It is sometimes necessary to use more support-

[1] Chief, regional agronomy division, Upper Mississippi Region, Soil Conservation Service, Milwaukee, Wis.

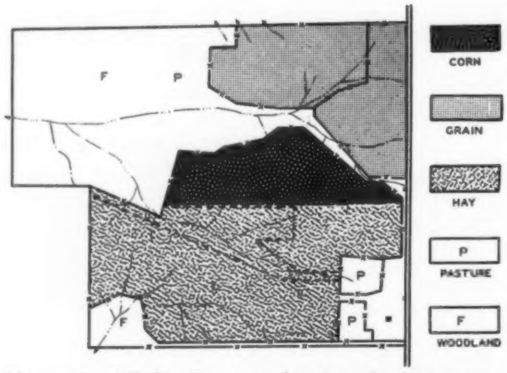

Figure 3.—"Before" map, showing drainageways, indicating very irregular slopes and farming without regard to topography.

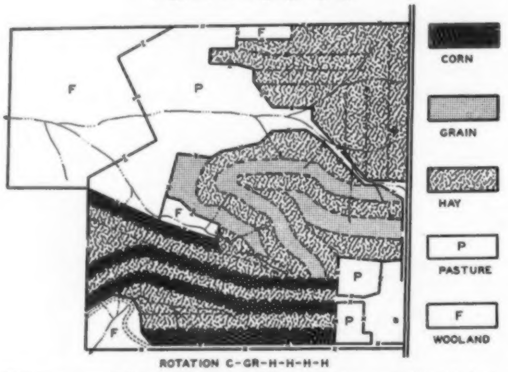

Figure 4.—Map of same farm after cropland has been planned in three field units of equal size, using a 6-year rotation of C-Gr-H-H-H-H. Each year all the corn will be in one unit, grain in a second unit, and hay in the third unit. Alternate strips of meadow between strips of corn or wheat afford adequate protection from erosion.

ing practices on some units than on others—terraces on unit 1, for example, so that one rotation can be used for all the field units on the farm. Buffer strips have been seeded between field units because they spread run-off water and facilitate contour tillage.

The question may be asked, Why is the farm planned in five field units, rather than four? The physical capability of this land answers the question in part, and the remainder of the answer came from the farmer. He wanted a large corn acreage and at the same time he wanted to reduce soil losses. If the cropland had been planned in four units, either of two rotations could have been used: (1) Corn-corn-grain-hay, which would have provided the farmer with necessary corn but would not have resisted erosion any more than his old plan; or (2) corn-grain-hay-hay in which case erosion would have been reduced but the farmer would not have had sufficient corn. Therefore, by planning a 5-year rotation, the farmer has sufficient corn—40 percent of the crop acreage—and at the same time a rotation that will adequately reduce soil losses—40 percent in an erosion-resisting crop.

One other point also may be considered here. The farm plan is made so that a change in the size or shape of field units is not necessary if the rotation is changed. All that is needed is a change of crops within the rotation. Because farmers sometimes do not understand the value of rotations in a soil-conservation program, or because of insufficient livestock on the farm to utilize the additional roughage in more extensive rotations, or for economic reasons, rotations are often changed after the farm is planned. Such a change should not affect the general plan for the farm, but should cause merely an adjustment or a shift of crops within the rotation.

The 180-acre farm in figures 3 and 4 represents a different application of the same method of planning. No definite rotation of crops, or any particular attempt at soil or moisture conservation, was made by the farmer previous to his cooperation with the soil-conservation district. As shown in figure 4, some of the woodland previously used for pasture was fenced out to protect it from grazing; the cropland was divided into three field units of equal size. A 6-year rotation of corn-grain-hay-hay-hay-hay was planned, and strip cropping was followed. Because of the uneven topography in two units it was necessary to use field stripping. Contour strip cropping was used on the third unit.

The three units of cropland are more or less a natural division. All are easily accessible and workable. In this arrangement, each year one field unit will have corn and second-year hay in alternate strips, one will have grain and third-year hay in alternate strips, and the third unit will have alternating strips of first- and fourth-year hay. This provides for effective erosion control and at the same time makes it possible for the farmer to utilize the high percentage of hay in the rotation. One field unit can be used each year for summer pasture, while the hay for winter feed can be obtained from the meadow strips in the other two field units.

As in the case of the first farm, this plan is flexible in that the crops within the rotation can be changed at any time without any material change in the general farm plan. If, because of economic conditions, more grain is needed, wheat can be substituted for some of the meadow crops.

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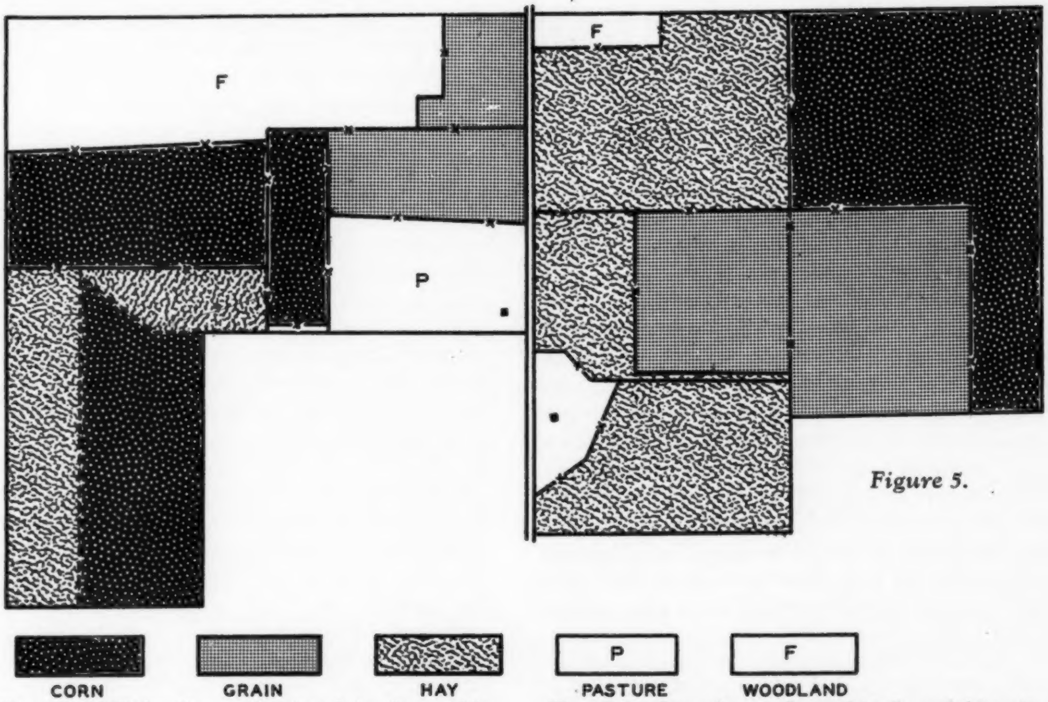
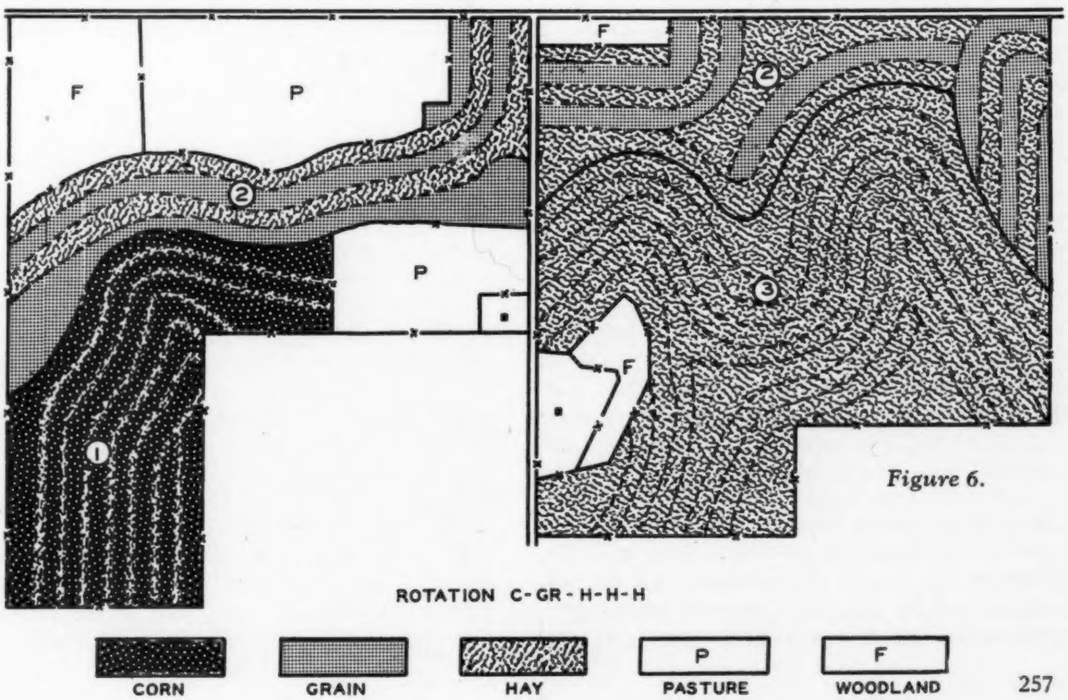


Figure 5.—"Before" map showing dairy farm without permanent pasture, no definite rotation, and a field arrangement without regard for contour.

Figure 6.—Same farm, planned in three field units, a 5-year rotation of C-Gr-H-H-H with contour strip cropping. Field unit No. 1 is only half as large as either of the other two units.



FIELD UNIT PLANNING

(*Continued from p. 256*)

It is not always possible to plan farms so that the cropland can be divided into three field units of equal size. The 270-acre farm shown in figures 5 and 6 is an example. The owners recognized considerable soil losses and had difficulty in maintaining sufficient grass for summer pasture and hay for winter feed for a herd of dairy cows. It was being farmed in 14 fields without any regard to topography. When it was replanned 3 field units were established, one of which is only half as large as either of the other two. Field unit 1 is approximately 43 acres, while field units 2 and 3 are approximately 82 acres each. The rotation was corn, grain, and 3 years of hay. Field unit 1 will have meadow 3 years out of 5. In the other 2 years, when it is in corn or grain, these crops will be supported by contour buffer strips. The other 2 field units will be contour strip cropped, and the crops will rotate in much the same manner as the units in the second farm described.

The following charts show the sequence of crops in two rotations by field units and strips with approximate acreages:

Field unit	Strip	Rotation C-Gr-H-H-H-H					
1[1] (31 acres)	A	C	Gr	H	H	H	H
	B	H	H	H	C	Gr	H
2[1] (34 acres)	A	Gr	H	H	H	H	C
	B	H	H	C	Gr	H	H
3[1] (28 acres)	A	H	H	H	H	C	Gr
	B	H	C	Gr	H	H	H

Field unit	Strip	Rotation C-Gr-H-H-H				
1 (43 acres)	([2])	C	Gr	H	H	H
2[1] (82 acres)	A	Gr	H	H	H	C
	B	H	H	C	Gr	H
3[1] (83 acres)	A	H	H	H	C	Gr
	B	H	C	Gr	H	H

[1] Field unit with two or a multiple of two strips.
[2] Not strip cropped; supported by buffer strips.

In order to show the further flexibility, other than a changing of crops within the rotation made necessary by a change in the farm enterprise or economic conditions, let us suppose that one of the meadow seedings fails. A spring grain can be sown with a reseeding of the meadow. Corn will be planted again in regular turn even though the meadow failed one year. The crops in the other strips will continue to rotate in accordance with the general plan, since they were not affected by the seeding failure.

Not all farms can be planned in this manner. There are many variations, however, that can be used for peculiar conditions on particular farms, and the ingenuity of planners will determine how far this method will be used. It is especially applicable in soil-conservation districts where farmers do the planning, where flexibility in cropping systems is essential to take care of necessary changes in the farm enterprise, and where simplicity is indispensable both for establishing and maintaining farm plans.

ELECTRIC POWER

(*Continued from p. 254*)

living in their vicinity. Typical examples are creameries, cheese factories, fruit and vegetable canneries, and woodworking plants. One of the most interesting is an alfalfa mill in the Brazos Valley near Bryan, Tex. Soil conservationists will be interested, perhaps, to know that since this mill was set up, alfalfa growing has become an important farm activity in what was for years almost wholly a cotton-growing region. The net effect of such development is to broaden the base of the farm community socially and economically.

R. E. A. systems, besides contributing to the well-being of their own communities, are performing institutional services of which the effects will be felt over a long period of time and far from the immediate locality. For example, the R. E. A.-financed Tuscarawas-Coshocton Electric Cooperative, in Ohio, provides current to operate electrical equipment used in the Ohio Watershed and Hydrologic Studies Station of the Research Division, Soil Conservation Service. Electricity is used for laboratory apparatus, for pumping, for meteorological recording devices, for the lysimeters, and for many other purposes. The contribution of R. E. A. to this soil-conservation-research undertaking is typical of similar contributions which the R. E. A. program is making to many other local, State, and Federal institutions—orphanages, hospitals, forest nurseries, fish hatcheries, airway light and radio beacons, N. Y. A. training centers, and C. C. C. camps, to mention only a few.

Experience has shown, during the nearly 6 years of the R. E. A. program, that electricity can be a valuable aid to the soil conservationist, as to all who are striving to improve the social and economic condition of the American farmer. It is now clear that, given suitable rates and conditions of service, electricity can pay its way on the small, family-size farm. To achieve the maximum benefits of high-line service requires a combination of research and education. New ways of applying electricity to farm operations must be found. Farmers served by the new lines must be shown how to take advantage of the opportunities for saving and profit already open, as well as of those that may be opened in the future. The job ahead is big; but, granted the continued cooperation of the various interested groups and agencies, it is not impossible.

A CONSERVATIONIST LOOKS AT CONSERVATION FARMING

BY HARRY C. DIENER[1]

NEARLY half a century ago, a wise old professor of geology at Harvard University, Nathaniel S. Shaler, posed one of the most disturbing questions an American has ever asked his country. "It is now a question," he wrote in 1896, "whether human culture, which rests upon the soil, can devise and enforce ways of dealing with the earth which will preserve this source of life so that it may support the men of the ages to come." In fewer words, Shaler might have asked, "Is an enduring civilization possible on this continent?"

In general, it may be said that nature is the best soil conservationist we have known, while man is the poorest. Across the centuries, nature gives a covering skin of vegetative matter to the earth which is ideally suited to the soil and climatic conditions of any given locality. In and on the soil she develops a balance of plant and animal life—a cycle of growth, decay, and reproduction.

When man breaks this natural balance by clearing away trees, by plowing up grasslands, by exposing the soil to wind, rain, and sun, the whole character of the land radically changes. The organic matter in the soil oxidizes and gradually disappears. As a result, the soil structure tends to break down and becomes less porous. Water evaporates more rapidly, and more of it runs downhill to swell the streams; soil washes away with the water, fills lakes and streams with silt, and clogs low lands with colloidal material which disturbs natural drainage. In short, the very acts of clearing and cultivation set in motion a whole train of new land and water relationships; the natural balance is replaced by a downward spiral of ever-accelerating run-off and erosion. It is this cycle that Shaler had in mind when he wondered, 44 years ago, whether civilization and soil conservation are compatible.

Earlier in the history of man when population was sparse and requirements were few, nomadic peoples could subsist on the wild products of natural vegetative growth. But sometime back in the unrecorded past an unknown genius conceived the idea of clearing the ground surface, planting seeds in the earth, and growing crops of his own choosing. From that day to this, as civilization has developed, man has become steadily more dependent upon the art, the science, and the business that we know as agriculture. Today civilization without agriculture is unthinkable; yet agriculture has contributed and is contributing powerfully in many countries toward the weakening and destroying of the basic land resource which is civilization's ultimate source of strength and life.

What is the answer? Is civilization on this continent inevitably a self-destroying process? Or can the ingenuity of man devise and enforce ways of solving this deeply disturbing paradox?

Attempts to control erosion in the United States are fully as old as the Nation itself. Washington, Jefferson, and other early leaders, who were farmers as well as statesmen, advocated erosion control and practiced it on their own lands. Throughout most of our history, there always have been a few farmers who perceived the dangers of soil washing and took active steps to prevent it. All too often, however, the end result was failure; and until recent years no definite attempt was made to attack the problem on anything like a Nation-wide scale.

In 1933, for the first time in our history, the Federal Government took cognizance of the soil-erosion evil when it organized the Soil Erosion Service in the Department of the Interior. In 1935 it was transferred to the Department of Agriculture, renamed the Soil Conservation Service, and given permanent status. In the 7 brief years of its existence, the Service has helped to bring erosion under control on many thousands of farms. Even more important, it has developed and fostered a new concept of conservation farming—a concept that holds real promise of providing an answer to Shaler's monumental question.

At the core of the Service's program is the idea of cooperation with nature. Realizing that a wholesale retreat to grass and trees would be economic and cultural suicide, the Service has nevertheless contended that we must go part way. We must approach nature's soil conserving efficiency as closely as possible and still provide for the needs of our human population.

This means that cultivation must be confined as far as possible to the level areas and the gentler slopes. It means that steep and erodible lands must go under soil-guarding cover of perennial vegetation. It also means the application of specific farming measures, such as contour cultivation, terracing, strip cropping,

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and many other devices, as a substitute for the intricate system of checks and balances created by nature under undisturbed conditions.

The farmer cannot change soil types or climate, but he can so manage the soil as to preserve its productivity, moisture-holding capacity, and general usefulness in a large measure of permanency. Conservation farming *does not mean* returning to nature's original vegetative cover on the land; and *it does not mean* merely the introducing of a few isolated conservation practices. It *does mean* the coordinating of all available physical and economic information for the farm as a unit and treating every last acre in accordance with its needs and adaptabilities, the type of farming and the resources that are available to the farmer.

If the objective of securing good land use and proper land management is ever attained, it will be because the principles advocated are simple, clear, and easily understood by the farmers and others. What the farmer wants to know is how much of his farm he can safely cultivate and at the same time receive an adequate return in profitable crops; and what practices, measures, and soil amendments he needs to supplement the vegetative growth for good conservation.

Assuming that the ideal of a permanent agriculture is sound, agriculture must become a planned business. Each individual farm must be planned as a business unit for the best long-time production program together with conservation of farm resources in accordance with the farmer's managerial ability. All sound planning is based on a definite, comprehensive inventory and a broad knowledge of applicable controls.

In planning for erosion control, it is necessary to determine for each field the extent to which erosion has damaged the land by soil removal, the degree and length of the slope, and the capabilities of the soil type itself. No one of these factors in itself, or any other one factor, is sufficient to use as a criterion for readjustment of farming. The fact that Caribou loam is an excellent potato soil, for example, does not give any guaranty that such soil wherever found in its present condition, is capable of producing a high yield of good, marketable potatoes. With the topsoil gone through the effects of erosion, rebuilding is necessary to get even mediocre results, and the topography may have been changed to such an extent that additional use of the land in row crops will eventually cause washing away of the remainder of the soil. Likewise, slope alone would not be a good indicator of necessary conservation work. A 5-percent slope on a shaley soil might not be a serious erosion hazard, but this same degree of slope on a fine sandy soil or on a wind-blown loess, would be an important factor in farming for good erosion control and moisture conservation.

The economic factors, likewise, are fundamental. The farmer should be, and in most cases is, sincerely interested in soil conservation. But at the same time he is in the farming business primarily to obtain an income rather than to conserve soil. If, then, a conservation farming program unnecessarily reduces his income or adds considerably to labor and inconvenience, he is not likely to become a wholehearted conservation farmer. A planned conservation program on a farm should take into account both the physical and economic factors which exist on the farm and the abilities of the farmer. The plan must be sound, practical, and understandable, and it must fit into ordinary farming methods. Each farmer, of course, is intensely interested in the welfare and longevity of the life of the country, but he is naturally more personally interested in his immediate present and future. All these facts must be considered in a conservation program.

Soil and moisture losses are not due to one or even a small number of causes, and no one remedy is a panacea for the ills. In the past the failures of certain mechanical erosion-control practices have taught scientists that no one practice is likely to be sufficient. If we had only to consider the physical control of water movement, or the holding of soil in place, we could develop controls that would be almost entirely effective. But the job is made more difficult and more challenging by the fact that each farm unit represents a business enterprise as well as a piece of land.

Adequate control of erosion is possible, however, if the farmer observes three basic tenets of good land use. First, there are only two groups of soils from the standpoint of use—those which can be safely cultivated, and those which should never be cultivated. Second, when soils which can be safely cultivated are used, they should be utilized in such a manner that satisfactory structure and fertility are maintained and wastage due to erosion is reduced to a minimum. Third, those soils which should never be cultivated should produce a continuous income in a well-managed program of grass production for hay or grazing; or they should be used for timber production; or to provide food and cover for wildlife on the farm. The farmer who recognizes these truths and uses his soils in this way is a conservation farmer.

Assuming that such a system is satisfactory, the lands considered suitable for cultivation present a varied and difficult problem. The types of crops, the crop rotations, the soil amendments, and the supple-

mentary mechanical measures must become a part of ordinary farm procedure. Furthermore, this farming procedure must lend itself to local conditions, and to the economic needs of the farmer.

Proper handling of cultivated land that is not fit for further tillage requires time, patience, and skill on the part of the farmer. As rapidly as possible, the farmer should revegetate these critical areas with a cover that is both erosion-resistant and economically valuable. Once the cover has been established, whether grass, trees, or shrubs, it should be managed with care so as to preserve its vigor and income-producing value.

Attempting to control erosion by the use of a single practice may be a waste of money; in fact, some conservation measures actually may do more harm than good unless fitted into a complete farm conservation plan in relation to other practices and methods of land use. For example, terracing alone, without consideration of land-use capability or crop rotation or disposal of surplus water, may cause failure of the entire system, with consequent loss and damage not only to the terraced land but even to adjoining fields. The introduction of legumes without proper attention to soil amendments may be a waste of money on seed. Merely designating an area of land to be retired from cultivation to pasture does not make it good pasture. Good grazing control, proper plant food, and careful management are all essential. The development of pasture or hay without planning for profitable utilization through livestock may also be an economic loss to the farmer.

The experience of the Soil Conservation Service definitely proves that lasting conservation benefits accrue only when a profitable use is found for each acre on the farm and when supplementary methods and practices become a part of ordinary farm work. The farmer must feel that phases of pasture management, such as controlled grazing, mowing for weed eradication, and fertilization, are as much a part of profitable soil use in pasture as having animals to utilize the grass. If summer and winter cover crops are necessary in orchards and clean-cultivated fields for soil protection and fertility maintenance, the farmer's cropping system must include them at the proper time. If mechanical measures are necessary on certain lands, they must become as much a part of the ordinary methods of farming the soils of those lands as is harvesting the crop. If woodlands already exist on the farm or if they are established as part of the conservation plan, careful management and systematic harvesting of the trees must become almost second nature with the farmer. Not until all erosion-control measures, such as rotation, strip cropping, terracing, use of cover crops, contour cultivation, fertilization, liming, controlled grazing, and woodland management, become a part of the regular farming system *in the proportions that they are needed* does the farmer have a conservation farming program.

This flexible and many-sided style of attack on the soil erosion problem already has proved its efficiency and value. In hundreds of Soil Conservation Service demonstration areas and in dozens of farmer-organized soil conservation districts, thousands of farms that were formerly going downhill and steadily losing soil have been made safe and secure against the ravages of rain and wind. These farms are now more efficiently organized and operated than ever before; many of them are producing better harvests and better incomes; and nearly all of them are supporting a more satisfactory way of living on the land. No longer can there by any doubt about the feasibility of controlling soil erosion.

During the past 7 years, Shaler's question has been affirmatively answered, at least in part. We have already devised "ways of dealing with the earth which will preserve this source of life so that it may support the men of the ages to come." Whether we can effectuate these conservation methods over all our eroding lands, in time to "head off" and eliminate the growing danger at our feet, is a question for the future.

Farm account record studies are showing that under average conditions, soil conservation practices pay on farms of Soil Conservation Service cooperators. However, in the records there are many farms which do not pay. Why? The chances are that the increased production of better pasture and feed crops are being fed to inefficient and unprofitable cows. The Bureau of Dairy Industry has just reported a study of a year's records kept on 675,000 cows by 28,000 members of Dairy Herd Improvement Association. Undoubtedly many of these dairy farms are in soil conservation districts. This study shows that the farmer keeping 18 cows that produce 200 pounds of butterfat each makes no more profit than the farmer keeping 10 cows producing 300 pounds of butterfat each. Think of milking 8 cows twice a day most of the year for nothing. Fewer and better cows can do a lot for soil conservation and make the work more popular with the farmers.

C. C. C. crews have planted about a quarter of a billion young trees in gullies and fields in need of permanent protection against erosion.

THE C.C.C.'S EIGHTH BIRTHDAY

BY G. H. GILBERTSON [1]

ON April 5, 1941, the Civilian Conservation Corps celebrates its eighth birthday.

On April 5, 1933, the President signed the executive order creating the C. C. C. Earlier that year, the President, conscious of two problems that seemed to complement each other, had conceived the idea of a new type of governmental organization. His thoughts went out to the thousands of young men who were out of work, in need of work. Those were depression days and there were no jobs. He thought frequently also of the condition of the natural resources of the Nation—wasting for want of man-power to halt the wastage and begin the program of conservation.

It may have occurred to the President that at the outset no new large administrative agency would be necessary—that perhaps 10 bureaus in 4 departments, all working together in one common enterprise under the coordination of a director and a small staff, could put the new program into action rapidly. A conference with the Secretaries of War, Interior, Agriculture, and Labor, the Director of the Budget, and the Judge Advocate General of the Army, confirmed his thought.

On March 21, the President sent to Congress a message asking for enabling legislation. He said:

"* * * I propose to create a civilian conservation corps to be used in simple work, not interfering with normal employment, and confining itself to forestry, the prevention of soil erosion, flood control and similar projects. I call your attention to the fact that this type of work is of definite, practical value, not only through the prevention of great present financial loss but also as a means of creating future national wealth * * *."

Ten days afterward Congress passed legislation empowering the President to make use of any and all Government departments needed to put the program into immediate effect. On April 5, the President signed an executive order appointing a Director of Emergency Conservation Work to carry out the purposes of the Act of Congress. This was the beginning of the C. C. C., for the name Civilian Conservation Corps met with public favor to such an extent that

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Congress later substituted it for "E. C. W." The soil-conservation program we know today was yet to be born, but there is no denying the fact that the provision for camp labor in the Executive order constituted an initial recognition of the need for an active erosion-control program on the farms of the country.

Erosion control was a part of the C. C. C.'s work almost from the beginning, and the first assignment of camps to the Soil Erosion Service, then just starting an emergency program as an agency of the Department of the Interior, came in April 1934. This was an allocation of 22 camps. Soon after April 1935, when the S. E. S. became a permanent agency of the Department of Agriculture and was renamed the Soil Conservation Service, the apportionment of camps was raised from 51 to 204.

The number of C. C. C. camps directed by the Soil Conservation Service has varied along with the total number of C. C. C. camps operated by all cooperating agencies. The peak number of soil-conservation camps was reached in September 1935, when 500 were demonstrating the value of erosion-control farming practices to the farmers of the Nation. There was then a grand total of 2,427 C. C. C. camps. Since January 1938, the total number of all C. C. C. camps has remained at about 1,500. During most of the past year the Soil Conservation Service has operated 391 camps.

Since 1934 camps have engaged in soil-conservation work in 758 localities in 42 States. Work has been carried out on 20,000,000 acres under agreement with the Soil Conservation Service, and today these areas are better able to withstand erosion because of the cooperation between farmers, the man-power of the C. C. C., and the technical services of the S. C. S. Viewed in the light of a demonstration of the effectiveness of erosion-control practices, the work on these 20,000,000 acres gains new significance.

Rough estimates of the number of different enrollees who have served enrollments in soil conservation camps place the total at more than a third of a million. Many of them were farm boys and as they return to farming they are able to put into practice the fundamentals of proper land use upon which the soil-conservation program is based. More than 1,100 former enrollees are now employed in the soil conservation program. They have learned their work from the bottom up, have ascended the rungs of the ladder one at a time, to regular jobs. The others, it is reasonable to expect, will in time mingle in almost every occupation. Their knowledge of the need of soil conservation will go with them to outposts otherwise beyond the reach of farming demonstrations.

Another benefit not to be overlooked is the training ground provided by the C. C. C. camps for the technicians needed in the growing soil-conservation program. Hundreds of employees in regional offices, areas, soil-conservation districts, nurseries, and elsewhere, received their initial experience in camps as superintendents, technicians, foremen, or as other members of the camp staff. Here, in contact with the

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Possibly this generation will never fully appreciate what the C. C. C. is doing to build the internal strength of America. So many things of immediate magnitude are taking place every day that we are likely to overlook some of the long-time gains being made in our time. But the C. C. C. is making history, and as history is written in the future it will record that in the 1930's and 1940's the C. C. C. made an invaluable contribution to the conservation of America's most vital natural resource—its soil.

I doubt seriously whether the importance of the C. C. C. contribution to soil conservation in the United States can be overevaluated. Working under the direct supervision of Soil Conservation Service technicians in camp areas throughout the country, C. C. C. enrollees have been the front line troops in the war on erosion. By providing the essential labor, they have provided added momentum to the conservation movement which today is reaching into the farming hills and valleys of the Nation—more extensively and more intensively than ever before.

On April 5, the C. C. C. marks its eighth birthday. It is an appropriate time for men and women in the Soil Conservation Service to recognize again the contribution of the organization that since the beginning has been working shoulder to shoulder with our own.—H. H. BENNETT.

workmen who plan and do the job in cooperation with the farmers who use the land, their experience has been practical rather than "bookish" and theoretical.

The C. C. C. has meant much to the conservation of natural resources; but these physical accomplishments represent only a part of its worth to the Nation. Time itself will serve to summarize the assets on the human side of the ledger.

Some of the Work Accomplishments of Soil Conservation C. C. C. Camps [1]

Impounding and large diversion dams...constructed..	2, 074
Fences relocated to permit contour farming..rods..	13, 511, 843
Treatment of gullies:	
Check dams, permanent and temporary.number..	3, 444, 455
Gully banks sloped.............square yards..	79, 734, 349
Gullies seeded and sodded..............do....	369, 260, 642
Tree planting for gully control..........do....	351, 897, 116
Diversion ditches................linear feet..	536, 706, 581
Terracing..............................miles..	26, 648
Terrace outletting:	
Channel construction.............linear feet..	38, 177, 783
Outlet structures...................number..	333, 204
Planting, seeding, sodding outlets.square yards..	113, 034, 801
Sheet-erosion planting....................acres..	537, 708
Wind-erosion area treated.................do....	14, 174
Limestone quarried.......................tons..	2, 094, 100
Land prepared for strip cropping...........acres..	187, 908
Contour furrows and ridges..............miles..	119, 497
Field plantings of trees, planted or seeded...acres..	235, 843
Roadside erosion-control demonstration....miles..	686
Man-days assistance given soil-conservation nurseries......................................	1, 737, 231
Drainage work:	
Clearing and cleaning channels and reservoirs square yards..	374, 009, 337
Excavation of channels (earth and rock) cubic yards..	66, 663, 182
Leveling spoil banks..................do....	11, 314, 099
Total man-days, all types of work...........	67, 738, 591

[1] From the beginning of operations to December 1940.

TOMBIGBEE-WARRIOR DISTRICT

(*Continued from p. 251*)

well established by years of tenure and by faithful service rendered. He can multiply the effect of his work many times by making a major portion of his contributions to groups rather than to individuals.

The county agent and his assistants can make a wider contribution by using organized groups than by dealing with individuals.

As to the work-unit technician, he can continue to show definite progress in farm planning and establishment of practices, provided he has the ability to use group action. By taking advantage of organized farm groups who are interested in the common problems and who have proper local leadership, he can devote a small part of his time to assisting the groups with the establishment of seasonal practices, and still have the major part of his time for farm planning.

I see no particular reason why a group of farmers who have selected a capable leader cannot establish any of the recognized conservation practices in their community just as well as could an agriculturist, provided, of course, they have the assurance that they can obtain any desired technical help from the agriculturist when needed. By taking the initiative in this work and developing their confidence by doing the job, they will acquire the new methods and develop pride in the accomplishment. The latter development is most essential to the future progress and stability of agriculture. I have seen unassuming farmers beam with pride while a group of visiting farmers viewed their successful efforts in a conservation program. The enthusiasm of the visitors and their laudatory comments made the farmers who had done the work determined to continue their programs and to do a better job.

The various agricultural agencies can use the same organized groups to promote the different phases of the farm program. They might find need to use different leaders in order to take advantage of the abilities of particular individuals and, certainly, to give more people training in leadership. It is conceivable that the county agent would choose one leader to assume responsibility for certain phases of the program, the vocational teacher another, the Farm Security Administration supervisor another, and still another would be chosen by the work-unit technician. By proper assignment of duties and collaboration among leaders there should be no confusion, overlapping of responsibility, or lack of understanding of any programs. By using this method a community could take advantage of all organized assistance in promoting a conservation program.

Although thus far the results of group action in the program of the Tombigbee-Warrior Soil Conservation District are not entirely satisfactory, they do indicate gratifying progress and the possibilities for even greater achievements. The supervisors now plan to use local leaders to a greater extent for creating group-action interest in tours, field studies, the establishment of practices and, to some extent, in farm planning.

Let's share the new and good ideas developed in the districts! Short summaries are wanted by SOIL CONSERVATION.—Editor.

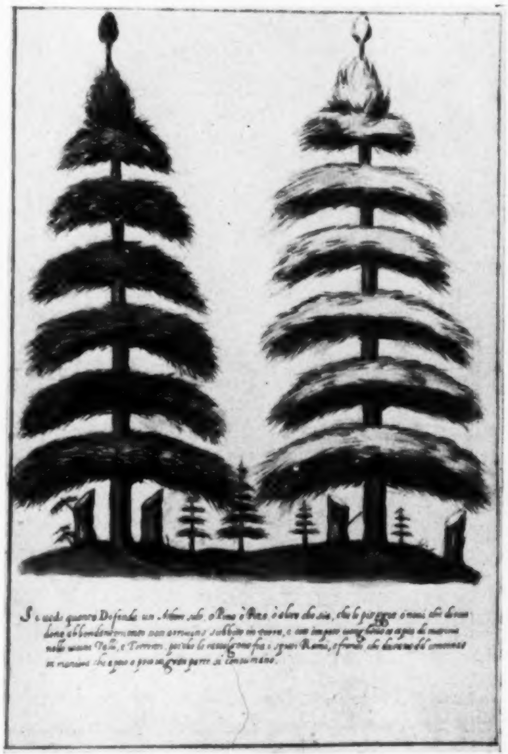
FROM THE ARCHIVES OF OLD VENICE

BY LOIS OLSON [1]

BEFORE the dawn of written history farmers of the Ancient World had learned how to prevent soil erosion on their sloping lands. By the Middle Ages, Italian scientists had described the cyle of accelerated erosion and applied its principles to selected river basins. Leonardo da Vinci, a contemporary of Columbus, used these principles in his plans for controlling the flow of the River Arno and increasing the agricultural area of Florence. In 1601 and 1602, when the eastern United States was still a wilderness, Guiseppe and Girolamo Paulini recommended and presented in detail a coordinated program of erosion control and river regulation to be applied throughout all of the territory of Venice, under the supervision of authorities appointed by the State. This is the earliest known nation-wide program for the control of accelerated soil erosion. Venice was then a powerful nation, not merely a city at the mouth of the Po.

For over 325 years the plans of the Paulini lay buried in the archives of Venice. No other city in the world can boast as many historians as Venice, but none of the histories mention the Paulini or their program for soil conservation and river regulation. Until 1934, neither the letters nor the drawings that accompanied them were published.[2] No mention of them was made by English or German writers. In 1936, *Revue des Eaux et Fôrets* published a brief French summary of the letters written by the Paulini in 1601 and 1602.

Guiseppe and Girolamo Paulini, the authors of the first two letters, were landowners in the little Serpentina Valley, a tributary of the Cordevole not far from its junction with the Piave. Before A. D. 1500 the surrounding mountains had been wooded and the valley prosperous. But now the Paulini were poor men—poor because the forests had been burned, the Serpentina had become a seasonal torrent, and the fields had been ruined by erosion and sedimentation. Although the Paulini could not afford to purchase better land, they were willing to pay for it with service. They offered to travel throughout the Venetian territory, wherever they were needed, to supervise the installation of their program of soil conservation



*"When a tree, a stump, or any other obstruction protects the land against heavy falls of rain or snow, the soil will not be ruined completely. * * * The water will be led gradually into the streams and, little by little, be absorbed by the soil."—The Paulini.*

and river regulation. In return they requested hereditary ownership of the fief of Fontanabuona in the province of Friuli, one of the best agricultural areas in Italy. There would be no other expense to the government.

The program of soil conservation was suggested at a critical period in the history of Venice. For centuries Venice had been the middleman for trade between Europe and the East; it was one of the wealthiest cities of the world. In 1453 a change began. The Turks captured Constantinople and trade with the East became more precarious. Fifty years later Vasco da Gama sailed around Africa to India and within another half century Portuguese trade with India was well established. Even Spain and her Italian rival,

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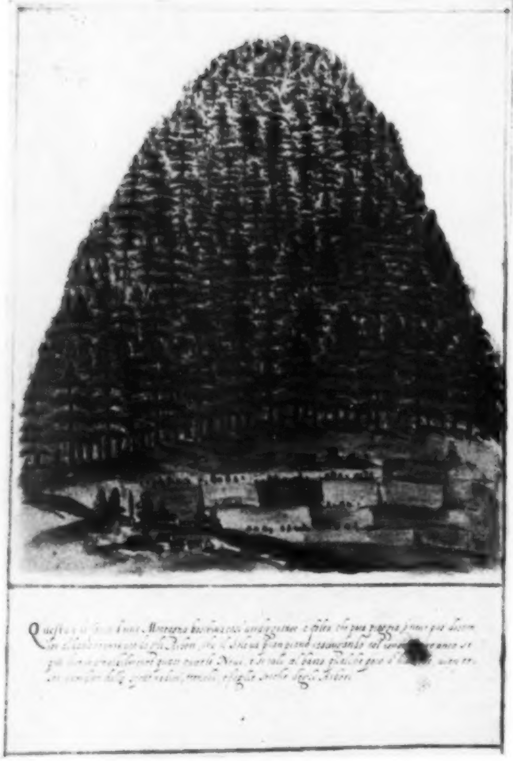
[2] In 1934 the letters and illustrations of the Paulini were published for presentation to Mussolini under the title "Un Codice Veneziano del '1600' per le Acque et le Foreste" (La Libreria dello Stato, Roma, anno XIII, e. f.). Reviewed in Rev. des Eaux et Fôrets 74: [168]–170. 1936.



A wooded mountain.

The mountain ruined.

Genoa, were better situated than Venice for trade with the East. For the first time, Venice began to take an active interest in the land.

In writing to the Council of Venice, the Paulini first explained that they had, with great care, worked out a plan for soil conservation and river regulation that would be of great benefit to the country as a whole. Although they offered Venice their services to supervise and initiate the program, the Paulini gave no indication of its nature or method of operation. The water authorities and administrators found the proposal worthy of consideration and wrote for further details.

Without delay, the Paulini sent a longer and more detailed letter, accompanied by about 20 drawings and paintings to illustrate the problems involved. The second letter is a short but masterly exposition of the causes of erosion, its relation to stream flow and sedimentation, and of the proposed control measures. They knew this would be a new type of undertaking for Venice, and the discussion is couched in the simplest of terms.

Of what avail, the Paulini ask, is the continuous dredging of rivers if the cause of silting is not removed? The mud and gravel are carried by waters descending with exaggerated liveliness from the mountains, which a hundred years earlier had been stripped of their vegetation. Before this, they continue, the rain seeped gradually through the ground litter of the forests and was stored in the soil. Trees shaded the snow and prevented rapid melting by the direct rays of the sun or by the hot south winds that blow from Africa. Now the forests are gone and the rain and melting snow flow madly off the hills, carrying with them sand and gravel. When the floods subside, the sediment is dropped. It blocks the rivers and prevents the flood waters from draining off naturally. In this way new swamps are formed on land that was formerly cultivated.

From their own observation the Paulini tell us that forest cutting causes little damage if new forests or cultivated fields replace the trees that have been cut to protect the soil. Burning is the root of the evil. Every year the Paulini have seen peasants in the mountains set fire to the vegetation in order to increase or renew their pastures. Fires respect nothing

and worm their way everywhere, even into places too rugged for pasturing sheep. The soil departs and rock appears. When the floods subside new marshes are formed in the valleys and the finer debris may be carried as far as Venice. The councilors, themselves, can observe the large proportion of ashes and other carbonaceous debris in the lagoon deposits. This will prove to them both the cause and the source of the silting.

The illustrations tell the same story, but more vividly. They were the Venetian counterpart of "What is Soil Erosion?" [3]—a bulletin recently published by the Soil Conservation Service, in which the technical aspects of soil erosion are simply explained by photographs. But the Paulini antedated the Soil Conservation Service by more than 325 years. Theirs is probably the first series of illustrations ever drawn that shows the complete cycle of erosion and sedimentation and suggests methods of control for an entire country.

The first drawings show in color a single tree covered with foliage that intercepts the rainfall and the snow. Then the same tree is shown with little tongues of orange flame licking up the trunk and along the branches. After the fire, only the charred skeleton of the tree remains and the forest litter at its base has been completely consumed. The water now, the Paulini explain, rushes toward the valley, carrying with it the soil from the mountains.

The next series of pictures shows a hypothetical mountain covered with trees. At its base is a prosperous little village, a small stream, and neat fields, obviously cultivated horizontally. When the trees are cut, terraced fields, separated by hedges or trees, spread up the mountain side. A winding tree-bordered road connects these with the valley and on either side of it the land has been left uncultivated. Above the fields is a zone of pasture land, but the top of the mountain remains wooded. The stream at its base has grown a little broader, but the countryside is still prosperous.

When fires attack it, however, the mountain becomes a seething mass of flames that sweep across the lower slopes, crawl through the forest, and leap from the mountain top. No vegetation is left and the soil is exposed to the elements. The next illustration shows the result of repeated burning. In some places landslides have exposed bare rock; in others, sheet wash has ruined fields. Gullies have cut into the slopes, and sediment has covered some of the lowland fields.

[3] Sharpe, C. F. Stewart: What is Soil Erosion? U. S. Department of Agriculture Miscellaneous Publication 286. 1938.

The mountain saved.

A torrent has replaced the little stream and the houses of the village have become mere hovels.

The Paulini used first a single tree and then a forest-covered mountain to illustrate the relation between vegetation and erosion and water flow. After the principles are developed, they are applied to the Serpentina Valley, where the Paulini themselves owned land. First they picture the valley as it was before A. D. 1500, surrounded by wooded mountains. Then, for contrast, the valley is shown as it appeared a hundred years later. Herdsmen have set fire to the vegetation to improve their pastures. The fires have grown beyond control and all of the forests are aflame. Torrents, instead of streams, rush down the mountain slopes, carrying with them appalling amounts of sediment. Each grain looks like a boulder, but the exaggeration only emphasizes the carrying power of the water. Some sediment has been dropped along the stream courses, but more of it has been caught by the turbulent waters. Eventually it will find its way to the lagoons near Venice.

The Serpentina is used to illustrate the destruction that had already occurred in many of the mountain

valleys surrounding the Plain of Lombardy. In order to reduce silting in the Venetian waterways, erosion must first be controlled in the higher lands. The problem is of national concern and cannot be solved by a single community.

Reforestation of the mountain slopes offered an ideal but not a practicable solution. It would limit too greatly the amount of farm land that could be cultivated. The Paulini recommended a compromise. If all burning were prohibited, the mountaintops would quickly cover themselves with a second growth of trees. Such areas were of no use for fields or pasture. On the cultivated slopes, ditches should be dug to distribute and retain the water until it had time to penetrate into the soil. Little soil would then be washed away and the moisture would percolate slowly through the ground providing the streams with a small but regular supply of silt-free water. On the valley floors, swamp land could then be reclaimed by confining the water in ditches bordering the fields and draining them into the rivers or into artificially constructed canals. How this work was to be accomplished is shown by diagrams.

The Paulini sent their plans to the Council of Venice early in 1602. For 6 years nothing further is heard of them. Then, in 1608, Guiseppe Paulini again wrote to the Venetian councilors, chiding them for their negligence. They had neither accepted his offer nor returned his plans. Possibly the Council was not entirely at fault. Guiseppe, apparently, had spent much of the intervening time in prison. Girolamo had either died or lost interest. His rights had been taken over by his Uncle Thomas. Venice, itself, was now in the midst of a long and bitter controversy with the Pope. The land had been forgotten.

Guiseppe, however, was still convinced that the preservation of the mountain lands and the regulation of the rivers was necessary for the welfare of Venice and he still wanted to own the estate of Fontanabuona in Friuli. He feared that the Council had considered the estate too generous a reward for his services. Venice was free to dispose of the estate because its last owner had died without an heir. Since then it had been rented to tenants. Although the rental was fixed at 1,000 ducats a year, plus a few other minor obligations, Guiseppe found that no tenant had ever paid more than 300 ducats. At this rate, he was asking very little in return for his services to Venice. Instead of retracting, Guiseppe suggested that Venice might well pay an additional 200 ducats a year to him and his uncle, jointly. The land, he said, had never been well cultivated and swamps detracted from its value. The restoration of the estate, alone, would be a service to Venice, he implied. The reclamation of farm lands throughout the mountain valleys, the drainage of swamp lands, and the regulation of the flow of the rivers was an enormous task that the Paulini were willing to undertake only because they were "especially devout servants" of Venice. But they were poor men.

Venice, however, was more concerned about the controversy with the Pope and the activities of the pirates of the Adriatic Sea than about the land. Like its predecessor, the last letter written by the Paulini was never answered, nor were the plans returned. The program of soil conservation and river regulation was not undertaken during the lifetimes of the Paulini. Other countries of Europe adopted forest codes, like the famous French Ordinance of A. D. 1669, but none of those adopted within 200 years after the time of the Paulini express as clearly as they did the close correlation of forests and erosion with floods and sedimentation.

In A. D. 1600, Venice was one of the wealthiest States of Europe with prestige enough to defy even the power of the Pope. But the fall of Constantinople and the discovery of the sea route to India already foreshadowed her decline. A hundred years later Venice adopted a program of land and water control similar to that proposed by the Paulini, but by this time Venice had become a second-rate sea power with little influence upon the affairs of Europe. Other countries were unaware of her program of soil conservation. What would have been the effects of the same program if it had been adopted a century earlier by the powerful State of Venice, and how many acres of farming land, the world over, might have been saved from the ravages of soil erosion?

Farmers of the Morgan Soil Conservation District in the Weber River Valley of the Wasatch Mountains in northern Utah have some excellent irrigated pastures, and many new seedings have been made. While there is considerable bluegrass in these pastures, a large part of the forage consists of orchard grass and white Dutch clover. Excellent work is being done in seeding wheat grasses on dry eroded fields and in rebuilding the range by proper stocking. The Deep Creek area has made remarkable recovery since 1937. A cooperative bull association owning four bulls and operating within a radius of 15 miles helps to maintain the high quality of the farm herds.

RODENTLESS RODENT EROSION

BY R. M. BOND[1]

A "gopher burrow" type of gully on Anacapa Island, Calif., where no gophers, ground squirrels, or moles occur. The cracks in the dry clay soil are clearly seen.

BURROWING rodents, such as ground squirrels and pocket gophers, are frequently accused of causing gullies. Moles, though not rodents, are included in the indictment.

The theory is that when a burrow runs up and down the slope, water flows in at the upper end and out at the lower end, enlarging the burrow until the roof caves in, leaving a gully. In many parts of the West I have been shown such "rodent damage." When a small gully is found leading into or out of a tunnel, the evidence is regarded as absolutely conclusive.

It is, of course, very likely that burrowing mammals do cause some of this type of erosion, especially where they are abundant, but it is a noteworthy fact that the tunnel type of "rodent gully" is especially common in heavy clay soils where rodents are relatively rare.

Recently it was my good furtune to visit Anacapa Island, off the southern California coast. The island has no pocket gophers, ground squirrels or moles, yet it contains many outstanding examples of what might be called, on the mainland, typical rodent-caused gullies.

The soils of the Anacapa Island range from a light-colored clay loam to heavy, dark clay, and appear to be dispersed. In the summer there is a very general formation of deep cracks and cross cracks down through the B horizon. Where surface vegetation is heavy the cracks are smaller and more numerous, possibly because of slower drying, and when the rains come these cracks close as the clay swells.

A number of years ago sheep were run on this island, and they largely or entirely denuded the soil of vegetation in certain places. Where the soil is laid bare, the cracks that have formed are long, wide and conspicuous. After the long rainless summer, usually about 4 months, during which the cracks are formed, torrential fall rains often occur. Then rainfall water runs into the interlocking cracks and downhill along their bottoms, sometimes for long distances. Often the water attains sufficient volume and velocity to cause considerable erosion before the clay can absorb enough moisture to swell the crack shut, and a tunnel is formed deep in the soil. Because of the dispersed nature of the material, the tunnel sloughs in and becomes increasingly large, maintaining always a roughly circular cross-section, until it becomes so large that the top caves in and a gully is formed. Many such tunnels were observed that were on the way to becoming gullies. One gully was roofed over (that is, the tunnel had not yet caved in) for a section 30 yards long, although it was open above and below the tunnel. Other gullies that must have started in the same way were 6 feet or more deep, and in places still actively eroding, though the sheep had long since gone from the area.

There are many areas on the mainland with similar climate and with soils that are susceptible to this same sort of tunnel and gully formation because of their physical or chemical nature. It is in just such places that rodents have the blackest reputations as erosion producers, though the evidence from Anacapa Island (and less conclusive evidence from the mainland, too) would seem to show that destruction of vegetation or other misuse of the land by man and his domestic animals is more generally to blame.

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RANGE SEEDING BY AIRPLANE

BY F. A. MARK [1] AND J. R. ROAF [2]

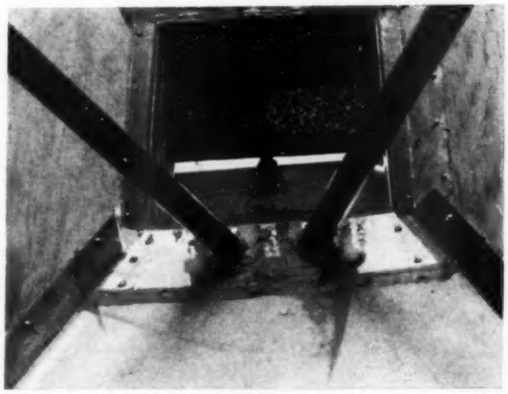
IN November 1939 the Soil Conservation Service seeded some 2,500 acres of Forest Service range land on the Squaw Creek demonstration project in Gem County, Idaho, for the purpose of reestablishing desirable vegetation.

The topography of these range lands is rough and mountainous with elevations of 3,500 to 4,500 feet. Pine and fir timber exists on the steep north slopes. The vegetation on the south and west slopes is made up largely of annual grasses, weeds and sagebrush with remnants of native bluegrass, bunch wheatgrass, fescues, balsamroot and other plants indicative of the virgin plant cover. The soils are of recent granitic origin. The slopes are mostly steep with sparse plant cover and hence very susceptible to erosion. An average annual precipitation of 21.4 inches was recorded at Ola, Idaho, from 1896 to 1906. This station is at an elevation of 3,100 feet, and is about 7 miles frcm the areas that were seeded.

Artificial revegetation of portions seeded was considered practicable because of the relatively high precipitation and potential productivity of the site as compared with other nearby sites that were seeded and observed over a period of years. With a proper protective cover it is expected that the area will be valuable for range forage production, will serve as a means of conserving water and controlling flood, will provide a habitat for upland game including deer, birds, and fish, and can be used to a limited degree for timber production.

Because of the inaccessibility of the areas, it was decided that airplane seeding was the most effective means of broadcasting the seed. The flying firm prepared for the job by reconstructing the interior of a 220-horsepower, 3-place cabin plane to allow room for a hopper with a capacity of 500 pounds of seed. Several test flights were made at the airport with the hopper loaded with sawdust, to study the operation of the hopper and the outlet. Then further test flights were made, using seed, on an easily accessible range area, and seed distribution was checked on long strips of muslin.

The actual seeding operations were carried out by flying at a height of 300 of 500 feet, so that the seeds were distributed in a swath about 100 feet wide. The flight lines used were about 100 feet apart and the areas were cross-seeded to assure adequate distribution. A ground inspector indicated the flight lines to the pilot, checked the distribution of seeds and flagged the plane from the job when the winds scattered the seeds too widely. Seeding was most satisfactory from daybreak to 10 a. m. and from 4 p. m. until dusk. The seed mixture consisted of 3 pounds of bulbous bluegrass to 1 pound each of crested wheatgrass and yellow sweetclover. A total of 5,875 pounds of seed was broadcast from the plane which was loaded 11 times. The 10 hours of flying time were distributed over 3 days, November 5, 6 and 7.



The inside of the seed hopper had capacity for 500 pounds of seed. The pilot used the rope control in the center to regulate the distribution.

For checking distribution of the seeds, 45 greased cards had been placed diagonally across a part of the area before seeding was started. These cards varied from 1 to 2½ square feet in size and totaled 67.54 square feet. They were placed about 135 feet apart. After the seeding operations had been completed, the seeds adhering to the greased cards were counted and recorded by species and, from the countings and records, calculations were made to determine the mean number of seeds of each species per square foot, based on the pounds of seed used and the size of the area seeded. The number of seeds to the pound was determined by counting and weighing representative samples. Further calculations were made to convert the recorded number of seeds per card to seeds per

(*Continued on p. 272*)

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BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neall Faris

MANUAL OF CULTIVATED TREES AND SHRUBS, 2d edition. By Alfred Rehder. New York, 1940.

Probably the biggest job of the botanists and horticulturists is keeping up with zones of hardiness of the plants of the planet. Somebody carries a seed, a "slip" or a good-sized "shoot," from zone to zone, hemisphere to hemisphere—a hundred thousand somebodies and as many seeds—and thus are zones of hardiness altered continuously by man's economic and aesthetic activities and tastes. The reviewer remembers most vividly a young apple tree, flourishing deep in a cool moist pit in the soil of a Cuban banana orchard. The banana farmer had tasted *fritura de manzanas*, apple fritters, on board a ship from the north; he would grow *manzanas*, make his own *frituras*, have apple fritters every day for breakfast. It would be well worth another trip to the giant of the Great Antilles to learn the present status, or predicament, or the fate, of Juan Perez's apple tree in the terra cotta colored soil of Província de Camagüey.

Professor Rehder intends this second and considerably enlarged edition for horticultural use, and when one attempts to visualize the tremendous amount of work involved in compiling and recompiling such a volume, then one at least knows something about his idea of the importance to horticulturists of accurate descriptions and authentic climatic zoning of the thousands of species used throughout the continent for their economic and ornamental values.

The point of view is hardiness-limits, not identification, although it is possible to trace and identify varieties and hybrids and species by family traits. Actually the book constitutes a systematic and descriptive enumeration of the cultivated trees and shrubs found to be hardy in North America exclusive of subtropical regions. In this edition, the zones of hardiness have been reduced from eight to seven, and many species have been moved over old zone lines as the result of recent experimentation. The great scope of territory "zoned" by Professor Rehder can be appreciated to some extent by a study of the map of climatic zones in the front of the volume: Zone I takes in treeless Northern Canada with a $-50°$ F. northern limit of hardiness; zone VII with a $+5°$ to $+10°$ minimum temperature, is the narrowest zone of all and swings as far south as New Mexico, Texas, and the Mexican boundary.

Since other factors besides temperatures influence hardiness, such as soil, exposure, rainfall and humidity, air drainage and shelter, Professor Rehder has included in the descriptions many suggestions as to culture, economic and ornamental properties of the trees, shrubs, and vines of the continent. These suggestions, modestly called "helpful hints" by the author, include information as to soils preference, value for timber, ornamentation (winter flowers, bright pods, grace of growth, autumn color), value for fruit, rapidity of growth, wood durability, name history, detail of local climatic preference.

Plant fanciers are sure to be intrigued by the rarer vines and woody herbs; while plant specialists—botanists, horticulturists or nurserymen, or even the man in the field putting the seed or seedling into the ground—will most certainly find a wealth of information in this edition of an already justly famous book. As for the taxonomists, they no doubt will have strenuous objections to some of the changes in nomenclature and transference of names. Nevertheless, Professor Rehder has made a valiant attempt to adhere to the existing and more or less accepted international rules of nomenclature. The fact that these rules require an immense amount of attention on the part of botanists the world over should not detract from the value to the practical horticulturist of this manual of trees and shrubs of North America according to zones of hardiness.

The Soil Conservation Service is a great user of plants, and there is little or no doubt that this new edition will be widely used by those whose duty it is to recommend and approve erosion control plantings for slopes, roadsides, woodlands, etc., throughout zones of hardiness III to VII inclusive. The descriptions, now rewritten and clarified, contain all available new knowledge concerning hardiness, and keys have been rearranged for clearer determination of relationships. The rarely cultivated species are described briefly and are appended to more fully described related species. Thirteen genera, 335 species, 220 varieties and 33 hybrids have been added to the section "Description of Trees and Shrubs," page 1 to page 900, inclusive.

Aside from an enlarged map of climatic zones, an excellent index, and the 900 pages of description, the volume contains sections explaining the abbreviations and signs used, a synopsis of Orders and Families included, an analytical key to Families and Aberrant Genera, additions and emendations, a glossary of botanical terms, and an explanation of authors' names as credited in the descriptions.

PUBLIC ADMINISTRATION AND THE UNITED STATES DEPARTMENT OF AGRICULTURE. By John M. Gaus and Leon O. Wolcott. Public Administration Service, Chicago: 1940.

Here is the Department of Agriculture in action—"one of the largest agencies of government in the world" thinking its problems "out loud" while undergoing a series of growing pains in keeping up with the needs of the times.

If the prospective reader is one of those in love with the routine mechanics of administration, doting on organizational charts and regulations, he should not request this book from the library. If, on the other hand, he is interested in such basic problems as production, distribution, land use, the quality of rural life, and the nutrition of the Nation—the fundamentals that lie behind mechanics in the Department—then here is a rare treat in store for him.

We in the Soil Conservation Service have a pretty good picture of how the Department's activities such as Farm Security, A. A. A., Rural Electrification, and the Extension Service operate "within the farm fence." As Gaus and Wolcott point out, however, that is only half the story. What goes on "outside the farm fence"—whether or not the problems of distribution and consumption with which other Department agencies are struggling are solved—may well decide the fate of our own work.

As the authors analyze the Department it becomes clear that it has assumed crucial responsibilities. Not only must the farmer and his land be protected by scientific production and management controls but improvement of the farmer's lot must not be at the expense of the consumer. The processor and distributor

BOOK REVIEWS AND ABSTRACTS
continued

also must be protected by fair standard regulations which the Department supervises.

Boiled down, the Department's struggle is a struggle against waste—the waste of labor, machines, and natural resources. "The many activities of the Department affecting production and the goals of production require the most careful integration if distortion is to be avoided. Here, in fact, is the crucial administrative problem of the Department."

Gaus and Wolcott are not cloister critics. Gaus, now chairman of Wisconsin University's political science department, has collaborated with Federal and State Governments on administrative problems for a quarter of a century. Wolcott, now secretary of the Commodity Credit Corporation, has been a lawyer, newspaper man, and research worker in the administration of natural resources.

While they like to discuss big issues and big names, they also show a surprising familiarity with the every-day problems of the field man in the local community. What ultimately happens in the local community is in fact their chief concern.

It appears from their study that the degree of coordination of the Department's many programs in the local community and region will ultimately decide the value of the Department itself to the Nation as a whole. In view of this fact, the authors are keenly interested in the soil-conservation districts and the local agricultural program-building and land-use planning committees.

If the people of the local community do really get together with the Department's field personnel, trained in the many natural and social sciences, and assist in formulating and executing programs of production, distribution, land use, credit, and rural living on a scientific basis without waste, then the Nation as a whole will greatly benefit.

The chapter, "Land Use," is especially enjoyable reading for the person interested in land-use history in the United States and the philosophy which underlies the Department's work in that field.

As the Department's structure is analyzed, it consists of three interdependent branches of activity whose personnel is often interchangeable: (1) General staff, composed of Secretary, special assistants and bureau chiefs, whose job is to "feel the pulse" of the country, determine policy and coordinate the Department's activity at the top; (2) Line agencies, or the action services which execute the duties of the Department whether in research or in the field; (3) Auxiliary services, such as the Library and Office of Personnel which facilitate the work of the general staff and the line agencies. An excellent analysis of the activity of one of the auxiliary agencies, the Office of Budget and Finance, is contained in an appended chapter by Verne B. Lewis who was later employed by that Office.

While the authors state in their foreword, "This study is not a comprehensive definitive description of the Department," one does not finish the book without a very good picture of the way it is put together and what makes it "tick."—E. C. Higbee, Soil Conservation Service, West Salem, Wis.

RANGE SEEDING BY AIRPLANE

(*Continued from p. 270*)

square foot for each species. A study of the results indicates that more uniform distribution might have been obtained had the species been seeded separately, although the additional cost would not have been justified. Differences in the specific gravities may have caused some separation in the hopper.

Technicians examined a representative portion of the seeded areas on April 18, 1940, and found an average of about 10 new bulbous bluegrass plants to the square yard, the number varying from 2 to innumerable plants. No plants were found of the other species in the mixture. Both the germination and distribution of the bulbous bluegrass seed, as determined by this observation, are considered highly satisfactory. Previous experiences warn against passing judgment on the establishment of the other species until a few years have elapsed.

The following recommendations and suggestions, developed during these seeding operations, are presented to assist in conducting future seeding from airplanes:

1. The cost of seeding was not excessive for this area and should be considerably less for larger areas or areas having less broken topography.

2. An adequate site analysis should be made to determine suitable species and possibilities of obtaining a forage-producing and erosion-resisting cover commensurate with the cost.

3. Provisions should be made to protect the seeded area from livestock until the new plants are well established.

4. Suitable base operations should be located in the vicinity. They should include landing field and means of protecting the plane and supplies from livestock and weather.

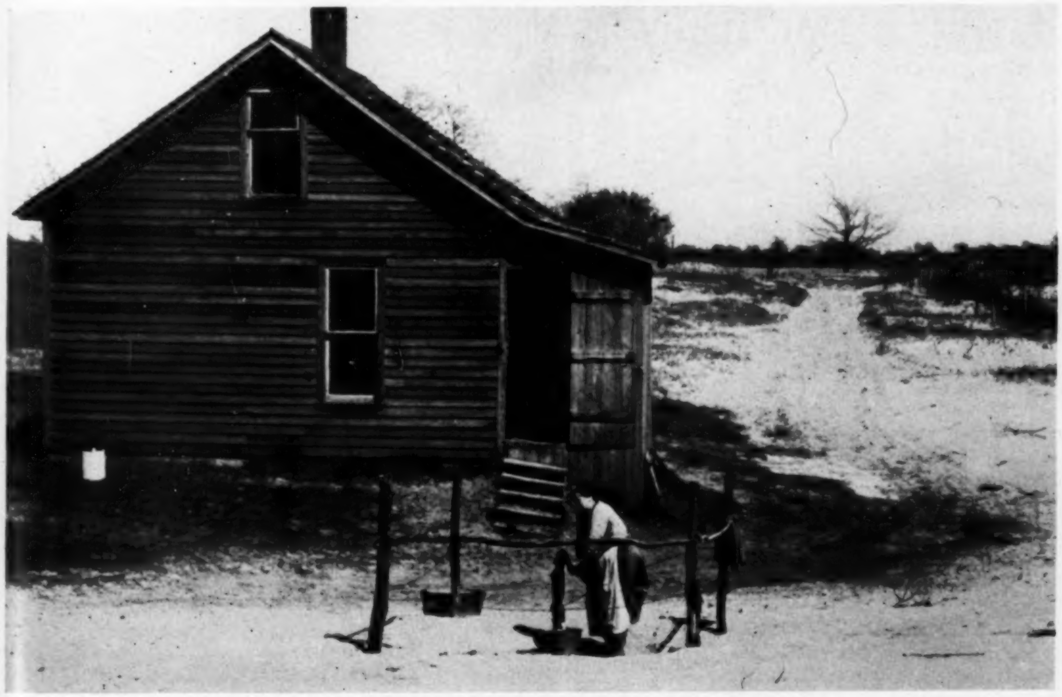
5. Provision should be made for the ground crew, both on the area to be seeded and at the base of operations.

6. Cross-seeding is recommended only when a full stand in the shortest possible time is desired, as in revegetating burned-over watersheds above municipalities or other valuable areas endangered by severe flood hazards.

7. Agreement should be reached regarding the minimum requirements for distribution of the seed as a basis of checking the distribution by the number and size of greased cards. The cards used in this seeding are considered to be too small. Cards 1 yard square probably would be adequate.

U. S. GOVERNMENT PRINTING OFFICE: 1941

In a sand blow area in Ottawa County, Mich. *See the article, "District Gives Blow Land New 95-Year Lease on Life," beginning on page 275.*



Owners of land like this find it difficult to pay taxes.

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Paling is used on sand blow areas to protect young pine plantings, explains A. M. Hedge in his article opposite.